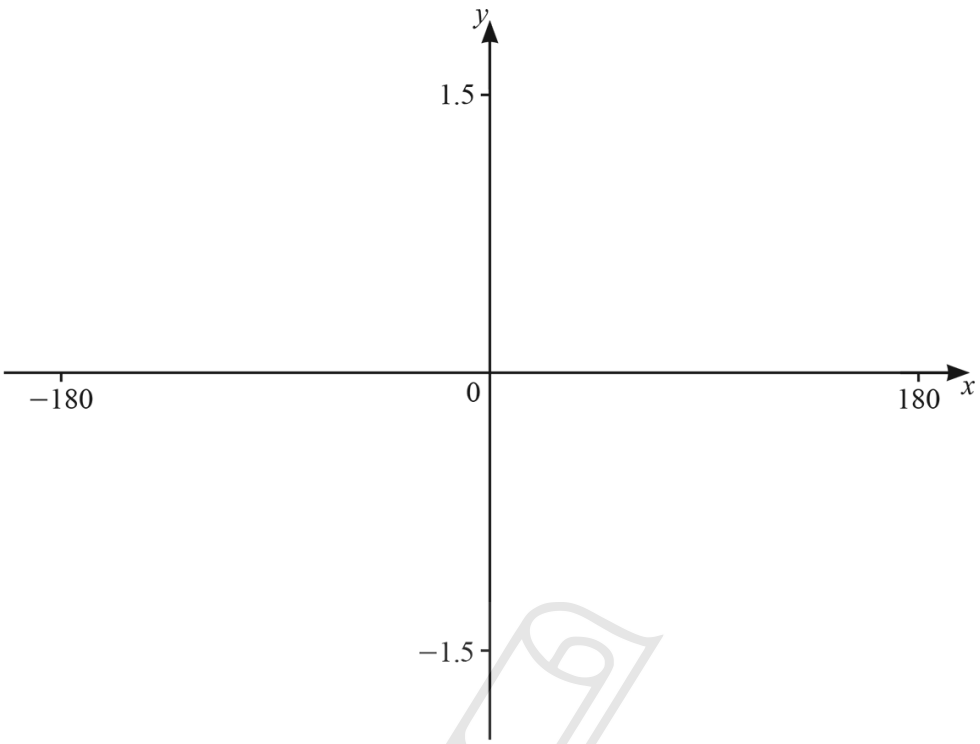
Chapter 3

Functions

01. 0607_m24_qp_42 Q: 1



$f(x) = (\sin x°)^2$

(a) On the diagram, sketch the graph of $y = f(x)$ for $-180 \leqslant x \leqslant 180$. [2]

(b) Write down the amplitude and period of $f(x)$.

Amplitude .....

Period ..... [2]

(c) $g(x) = 0.002x + 0.5$

(i) On the diagram, sketch the graph of $y = g(x)$ for $-180 \leqslant x \leqslant 180$. [2]

(ii) Solve $g(x) = f(x)$ for $-180 \leqslant x \leqslant 180$.

..... [4]

(iii) Solve $g(x) < f(x)$ for $-180 \leqslant x \leqslant 180$.

..... [2]

02. 0607_m24_qp_42 Q: 10

$f(x) = 3x - 2$ $g(x) = 5 - 2x$ $h(x) = x^2$

(a) (i) Find $g(-2)$.

..... [1]

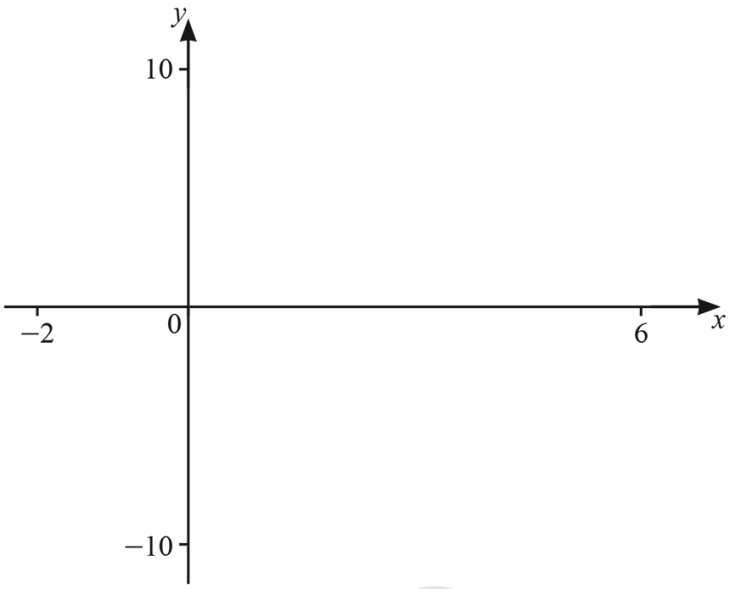
(ii) Find $h(g(x))$.
Write your answer in the form $ax^2 + bx + c$.

..... [3]

(iii) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(b) (i) On the diagram, sketch the graph of $y = \dfrac{f(x)}{g(x)}$ for values of x between -2 and 6.



[3]

(ii) An asymptote to the graph of $y = \dfrac{f(x)}{g(x)}$ is parallel to the y-axis.

Find the equation of this asymptote.

..... [1]

(iii) Solve $\dfrac{f(x)}{g(x)} = 5 - 2^x$.

..... [3]

03. 0607_s24_qp_41 Q: 11

$f(x) = 3x - 1$ $g(x) = 5 - 2x$ $h(x) = \frac{1}{2x-3}, \quad x \neq 1.5$

(a) Find $f(4)$.

..... [1]

(b) Solve $f(x) = -7$.

..... [2]

(c) Find $g^{-1}(x)$.

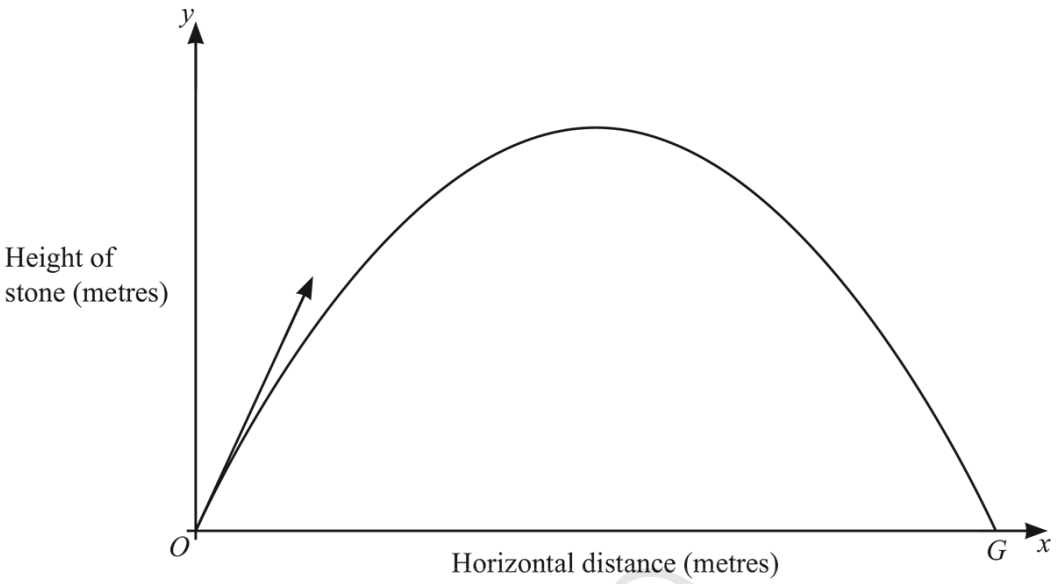
$g^{-1}(x) =$ ..... [2]

(d) Solve $g(x) = 7h(f(x))$.
You must show all your working.

$x =$ ..... [6]

04. 0607_s24_qp_42 Q: 3

(a)



Vic throws a stone from point O.
The stone travels through the air and lands at point G.
The sketch graph shows the path of the stone.

The equation of the path of the stone is $y = x - \frac{x^2}{10}$.

Draw this graph on your calculator to answer the following questions.

(i) Find the height of the stone when $x = 7$.

..... m [1]

(ii) Find the maximum height of the stone.

..... m [1]

(iii) Find the distance OG.

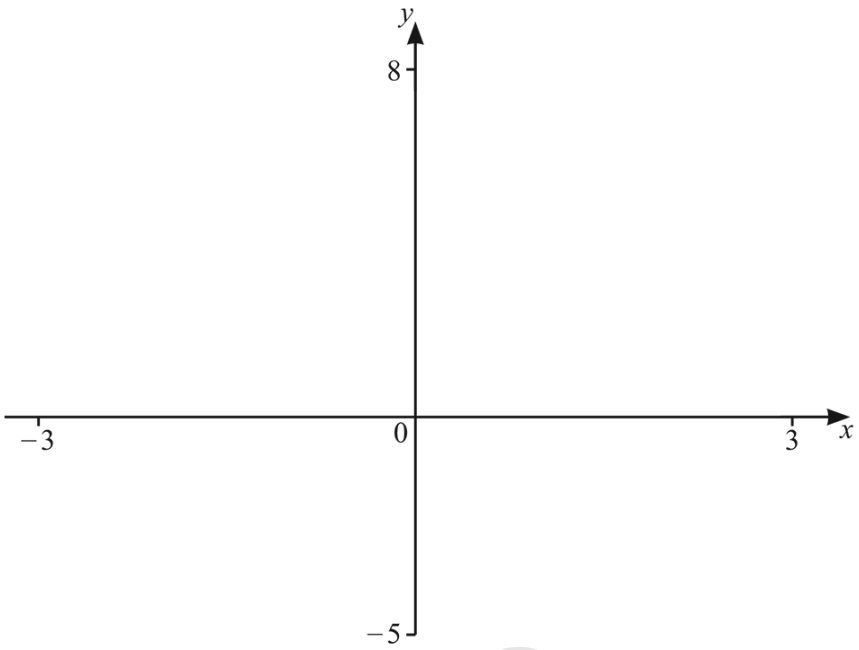
..... m [1]

(iv) There are two points in the path of the stone where its height is 2 m.

Find the horizontal distance between these two points.

..... m [2]

(b)



$f(x) = 2^x - \frac{1}{x}, x \neq 0$

(i) On the diagram, sketch the graph of $y = f(x)$ for values of x between -3 and 3. [3]

(ii) Write down the equation of each asymptote.

..... [2]

(iii) $f(x) = k$ has two solutions.

Find the range of values of k.

..... [1]

(iv) $g(x) = 3 - x$

(a) On the diagram, sketch the graph of $y = g(x)$ for values of x between -3 and 3. [2]

(b) Solve the equation $f(x) = 3 - x$.

..... [2]

05. 0607_s24_qp_42 Q: 9

(a) $f(x) = 3 + 2x$ $g(x) = x^2 + 1$ $h(x) = x^5$

(i) Find $f(-5)$.

..... [1]

(ii) Find the value of h(f(9)).
Give your answer in standard form correct to 4 significant figures.

..... [3]

(iii) Find g(f(x)), giving your answer in the form $ax^2 + bx + c$.

..... [3]

(iv) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(v) The domain of h(x) is $-1 \leqslant x \leqslant 2$.

Find the range of h(x).

..... [2]

(b) $\mathrm{j}(x) = \log(2x),\ x > 0$

(i) Find x when $\mathrm{j}(x) = 3$.

..... [2]

(ii) Find $\mathrm{j}^{-1}(x)$.

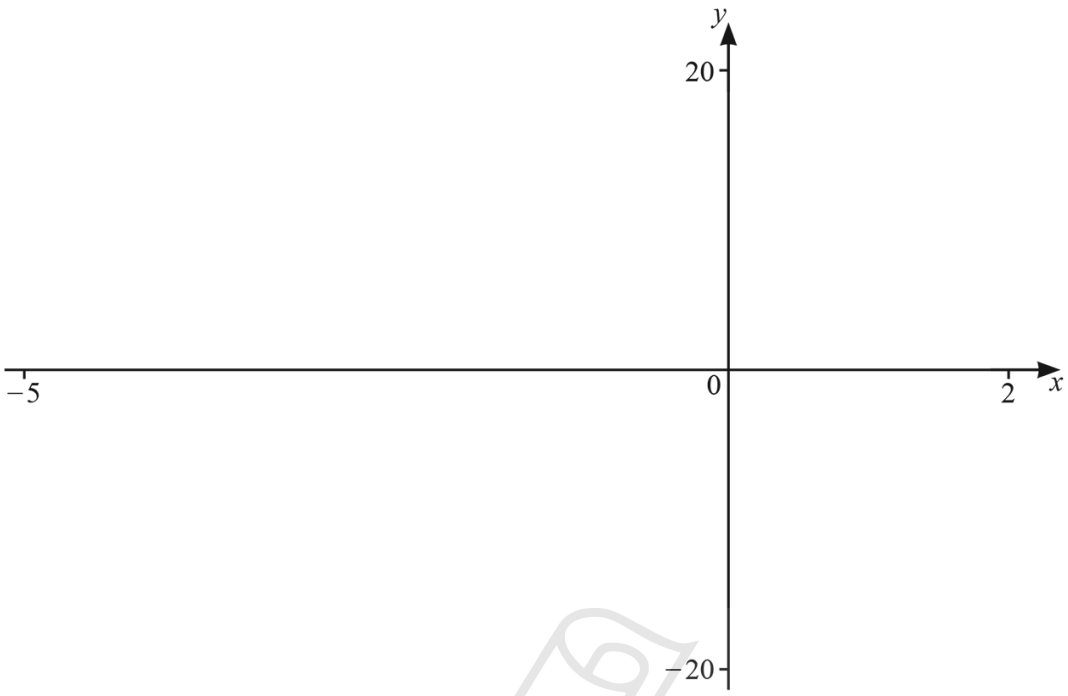
$\mathrm{j}^{-1}(x) =$ ..... [2]

(iii) $\mathrm{j}(w) = 3\mathrm{j}(x)$

Find w in terms of x.

$w =$ ..... [2]

06. 0607_s24_qp_43 Q: 5



$f(x) = 5 + 2x - 4x^2 - x^3$ for $-5 \leqslant x \leqslant 2$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the zeros of $f(x)$.

..... [3]

(c) Write down the coordinates of the local minimum.

(..... , ...) [2]

(d) The point (a, b) lies on the graph of $y = f(x)$ where the gradient is positive.

Find the range of values for a.

..... [2]

(e) The equation $5 + 2x - 4x^2 - x^3 = k$ has exactly one solution.

Write down a possible value of the integer k.

..... [1]

07. 0607_s24_qp_43 Q: 10

$f(x) = 5 - \frac{1}{2}x$ $\quad g(x) = 3(x+1)$ $\quad h(x) = \sin x°$ for $0 \leqslant x \leqslant 180$

(a) Find $f(3)$.

..... [1]

(b) Solve $f(x) = 2$.

$x =$ ..... [2]

(c) Find and simplify $f(g(x))$.

..... [2]

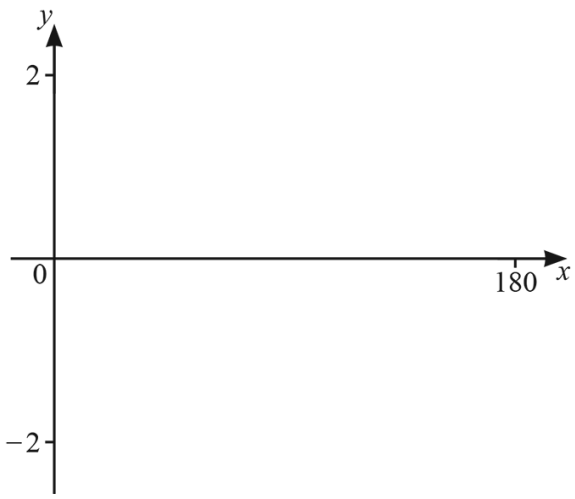
(d) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(e) Find $h(g(29))$.

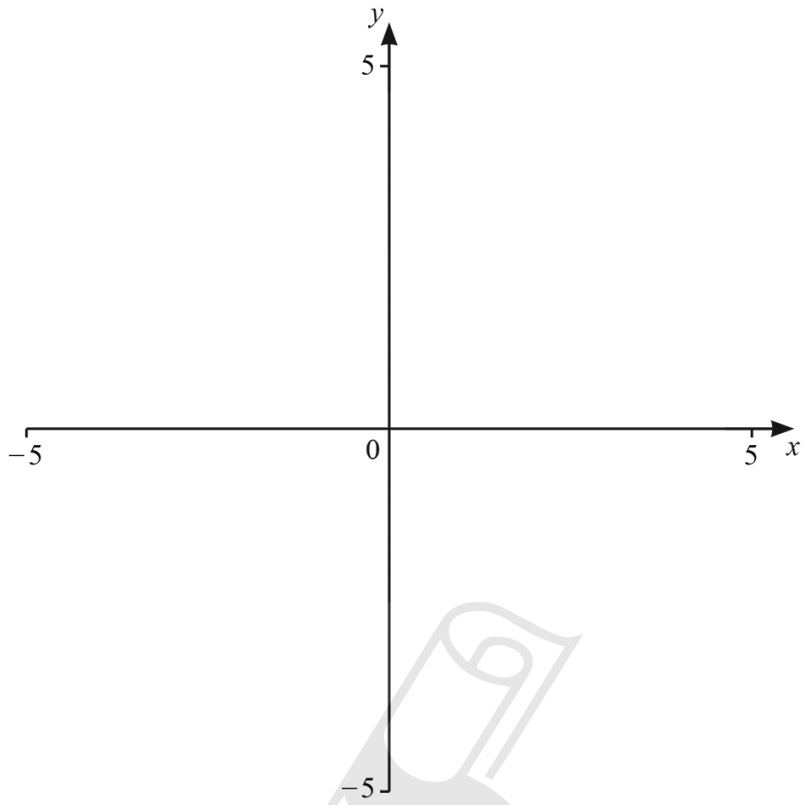
..... [2]

(f) Using a graphical method, solve $h(g(x)) = 1 - 0.01x$.



..... [5]

08. 0607_m23_qp_42 Q: 6



$$f(x) = 2 - \frac{x^2}{x^2 - x - 2}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -5 and 5. [4]

(b) Write down the equations of the two vertical asymptotes.

..... , ... [2]

(c) Write down the coordinates of the local minimum point.

(..... , ...) [1]

(d) On the diagram, sketch the graph of $y = g(x)$, where

$$g(x) = 3 - x \quad \text{for } -2 \leqslant x \leqslant 5 .$$ [1]

(e) **(i)** Solve the equation $f(x) = g(x)$.

..... [2]

(ii) Solve the inequality $f(x) > g(x)$.

..... [3]

$f(x) = |\cos x°|$ for $0 \leqslant x \leqslant 360$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the zeros of $f(x)$.

..... [2]

(c) **(i)** Solve the equation $f(x) = 0.5$.

..... [2]

(ii) Solve the inequality $f(x) < 0.5$.

..... [2]

(iii) On the diagram, shade the regions that satisfy the inequalities $y < 0.5$ and $y > f(x)$. [1]

(d) The equation $f(x) = k$ has four solutions.

Complete the statement to show the range of possible values of k.

..... $<$ k $<$ ..... [1]

10. 0607_s23_qp_41 Q: 6

$f(x) = 3-2x$ $g(x) = x+1$ $h(x) = (x+1)^2$ $j(x) = \tan x°$ for $0 < x < 180$

(a) Find $f(-1.5)$.

..... [1]

(b) Find h(h(2)).

..... [2]

(c) Find g(f(x)), giving your answer in its simplest form.

..... [2]

(d) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(e) Find x when $j^{-1}(x) = 75$.

..... [2]

11. 0607_s23_qp_42 Q: 11

$f(x) = 2x + 5$ $g(x) = 1 - 3x$

(a) Find $f(-2)$.

..... [1]

(b) Solve $f(g(x)) = 19$.

..... [3]

(c) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(d) $y = \frac{g(x)}{f(x)}$

Find x in terms of y.

$x =$ ..... [3]

12. 0607_w23_qp_41 Q: 2

$f(x) = \frac{1}{\sin x^\circ}$ for $0 \leqslant x \leqslant 360$

(a) On the diagram, sketch the graph of $y = f(x)$. [3]

(b) Find the coordinates of the local minimum point.

(..... , ...) [1]

(c) Write down the equations of the three asymptotes of the graph of $y = f(x)$.

..... , ... , ... [2]

(d) The equation $f(x) = k$ has no solutions.

Write down the range of values of k.

..... [2]

(e) By sketching another graph on the diagram, solve the equation $\frac{1}{\sin x^\circ} = 5\sin\left(\frac{x}{2}\right)^\circ$ for $0 \leqslant x \leqslant 360$.

..... [3]

13. 0607_w23_qp_41 Q: 4

(a) $\mathbf{p} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -5 \\ 1 \end{pmatrix}$

(i) Work out $\mathbf{p} + 2\mathbf{q}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(ii) A is the point (2, 6) and B is the image of point A after a translation by the vector $\mathbf{p}$.

Find the coordinates of B.

(..... , ...) [1]

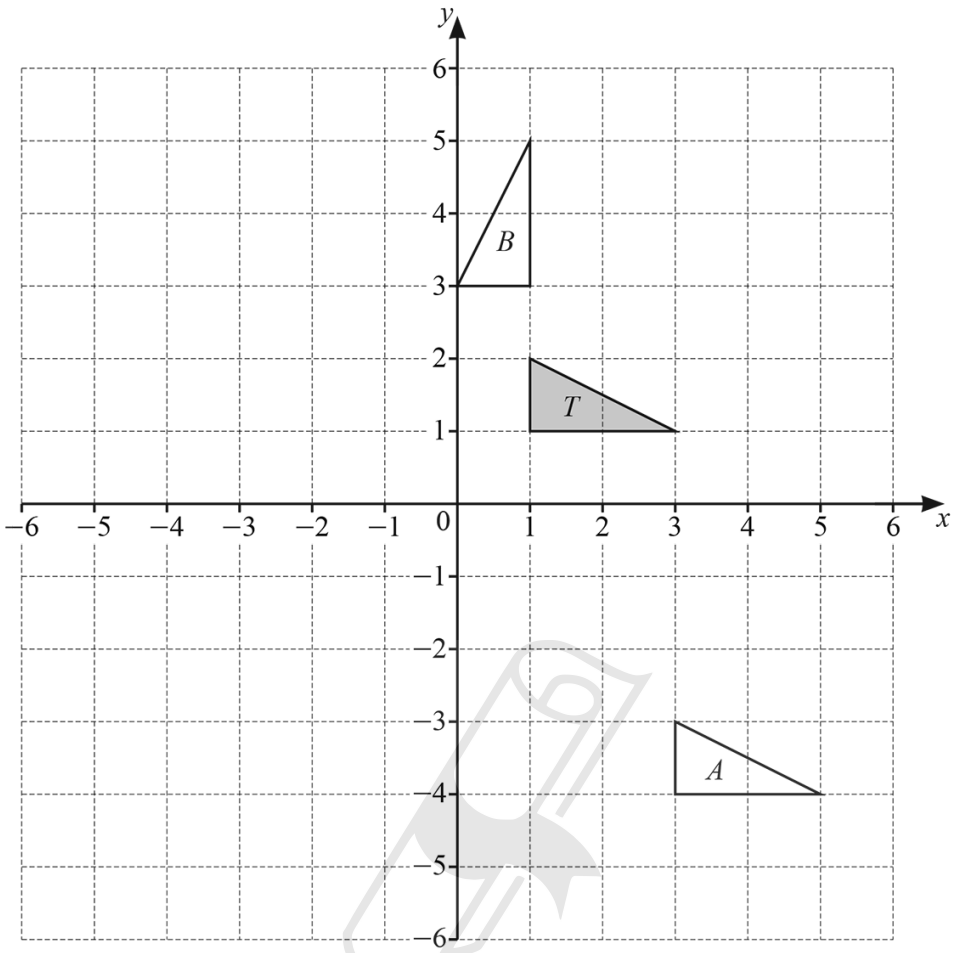
(iii) Find the magnitude of $\mathbf{q}$.

..... [2]

(b) Find the vector that translates the point (1, 5) to the point (−1, 7).

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(c)



(i) Describe fully the **single** transformation that maps triangle T onto triangle A.

.....

..... [2]

(ii) Describe fully the **single** transformation that maps triangle T onto triangle B.

.....

..... [3]

(iii) Reflect triangle T in the y-axis. [1]

(iv) Stretch triangle T with factor 3 and invariant line $y = 3$. [2]

14. 0607_w23_qp_41 Q: 5

$f(x) = 2x - 5$ $g(x) = x^2 + x + 3$ $h(x) = x^3$ $j(x) = 3^x$

(a) The domain of $f(x)$ is $0 \leqslant x \leqslant 10$.

Find the range of $f(x)$.

..... [2]

(b) Solve.

(i) $f(x) = -2$

$x =$ ..... [2]

(ii) $g(x) = 3 - x$

$x =$ ..... or $x =$ ..... [3]

(c) Find $g(f(4))$.

..... [2]

(d) Find $h(2) - j(2)$.

..... [2]

(e) Find $h^{-1}(x)$.

$h^{-1}(x) =$ ..... [1]

(f) Find $j^{-1}(x)$.

$j^{-1}(x) =$ ..... [2]

15. 0607_w23_qp_41 Q: 7

(a) Marcus runs for 1 hour at x km/h and then walks for 2 hours at $(x-5)$ km/h.
He travels a total distance of 14 km.

Find his running speed.

..... km/h [3]

(b) Nina runs 5 km at y km/h and then walks 7 km at $(y-7)$ km/h.
She takes a total of 2 hours.

(i) Show that $2y^2-26y+35=0$.

[3]

(ii) Solve $2y^2-26y+35=0$.

$y =$ ..... or $y =$ ..... [3]

(iii) Find Nina's walking speed.

..... km/h [1]

16. 0607_w23_qp_42 Q: 2

$f(x) = 2x + 4$ $g(x) = x - 1$ $h(x) = x^2 - 3x$

(a) Find

(i) $f(3)$

..... [1]

(ii) $h(7)$.

..... [1]

(b) Find the value of x when $g(x) = -6$.

$x =$ ..... [1]

(c) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(d) Simplify $f(x) \times g(x) + 1$.

..... [2]

(e) Solve $h(g(x)) = 0$.

$x =$ ..... or ..... [3]

17. 0607_w23_qp_43 Q: 10

$f(x) = 4x - 1$ $g(x) = 3 - 2x$ $h(x) = 4(2 - x)$

(a) (i) Find $g(-3)$.

..... [1]

(ii) Find $f(h(4))$.

..... [2]

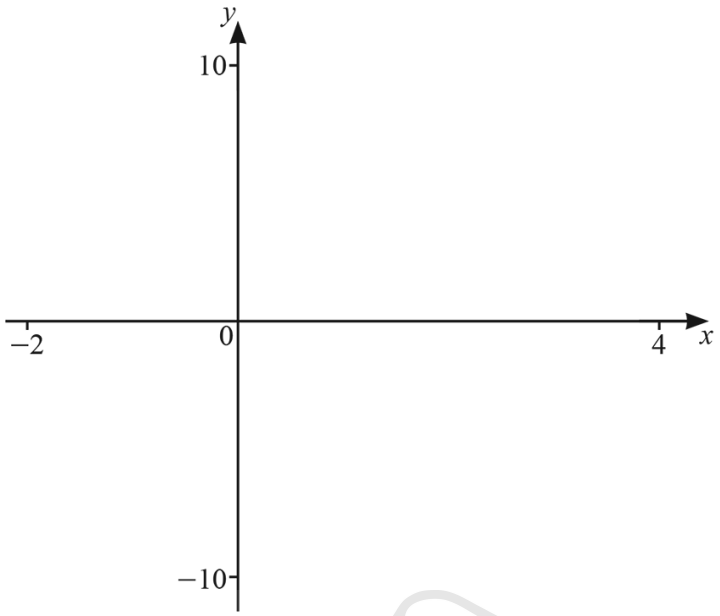
(iii) Find $g(f(x))$.
Give your answer in its simplest form.

..... [2]

(iv) Find $h^{-1}(x)$.

$h^{-1}(x) =$ ..... [2]

(b) (i) Sketch the graph of $y = \dfrac{f(x)}{g(x)}$ for values of x between -2 and 4.



[3]

(ii) Write down the equation of the asymptote which is parallel to the y-axis.

..... [1]

(iii) Use the graph to solve $h(x) = \dfrac{f(x)}{g(x)}$.

$x =$ ..... or $x =$ ..... [3]

(iv) $h(x) = \dfrac{f(x)}{g(x)}$ can be rearranged to the form $ax^2 + bx + c = 0$.

Find the value of a, the value of b and the value of c.

$a =$ .....

$b =$ .....

$c =$ ..... [3]

18. 0607_w21_qp_43 Q: 12

(a) Solve.

(i) $9 = 5 - \frac{2}{x}$

$x =$ ..... [3]

(ii) $\frac{6}{x-4} > 3$

..... [3]

(b) **(i)** Solve the equation, giving your answers correct to 3 significant figures.

$$2x^2 - 5x + 1 = 0$$

$x =$ ..... or $x =$ ..... [3]

(ii) Use your answers to **part (b)(i)** to solve

$$2(\tan y)^2 - 5(\tan y) + 1 = 0 \qquad \text{for } 0° \leqslant y \leqslant 180°.$$

$y =$ ..... or $y =$ ..... [2]

19. 0607_s15_qp_41 Q: 5

(a) y varies inversely as the square root of x.
$y = 5$ when $x = 9$.

(i) Find the value of y when $x = 25$.

Answer(a)(i) $y =$ ..... [2]

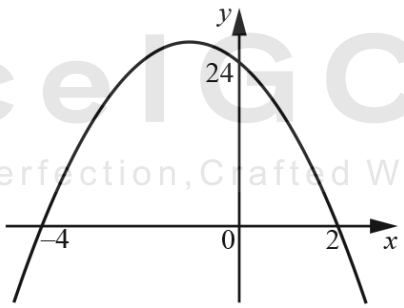
(ii) Find the value of x when $y = 25$.

Answer(a)(ii) $x =$ ..... [2]

(iii) Find x in terms of y.

Answer(a)(iii) $x =$ ..... [2]

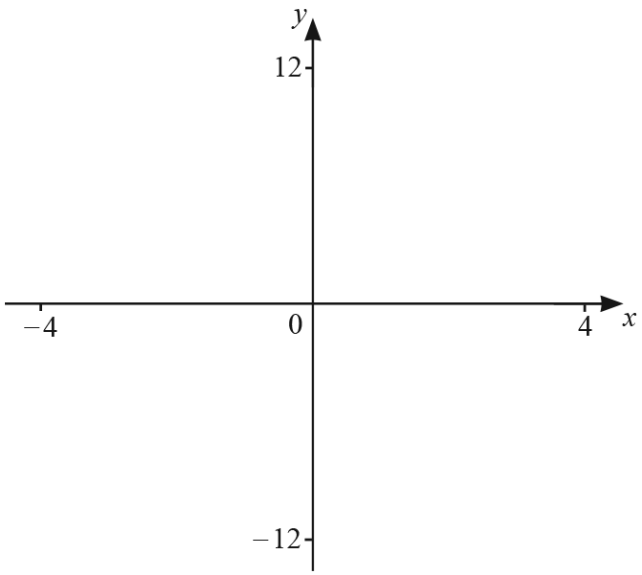
(b)



Find the equation of this quadratic curve.

Answer(b) ..... [3]

20. 0607_m22_qp_42 Q: 7



$f(x) = |4 - x^2|$ for $-4 \leqslant x \leqslant 4$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Write down the zeros of $f(x)$.

..... [2]

(c) Write down the coordinates of the local maximum.

(..... , ...) [1]

(d) The equation $|4 - x^2| = k$ has 4 solutions and k is an integer.

Write down a possible value of k.

$k =$ ..... [1]

(e) (i) On the diagram, sketch the graph of $y = 2x$. [1]

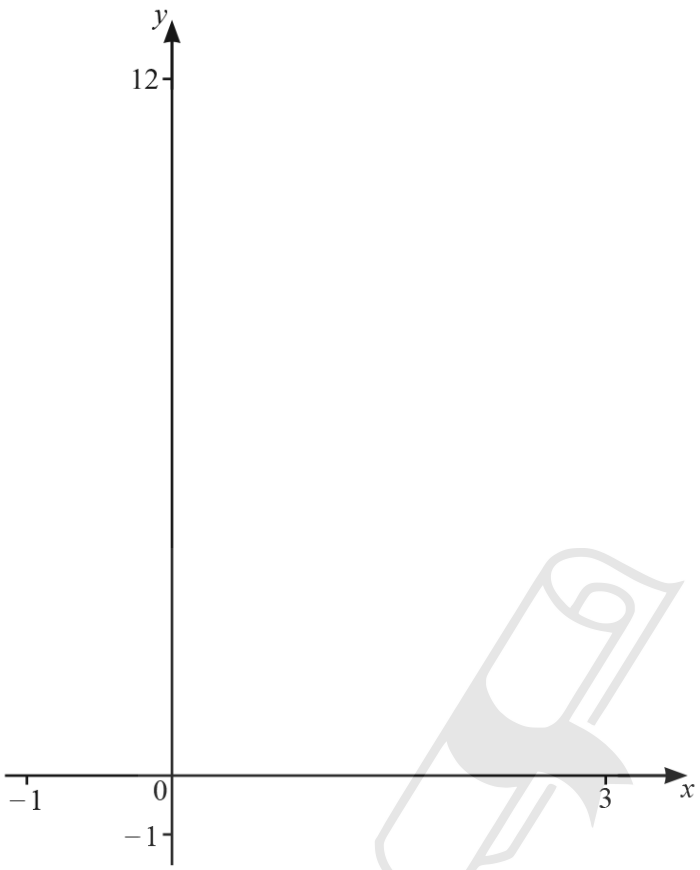
(ii) Solve the equation $|4 - x^2| = 2x$.

..... [2]

(iii) On the diagram, shade the regions where $y \geqslant 0$, $y \leqslant 2x$ and $y \leqslant |4 - x^2|$. [2]

21. 0607_s21_qp_41 Q: 11

(a) Using a suitable sketch, solve $5^x = 10$.



$x =$ ..... [3]

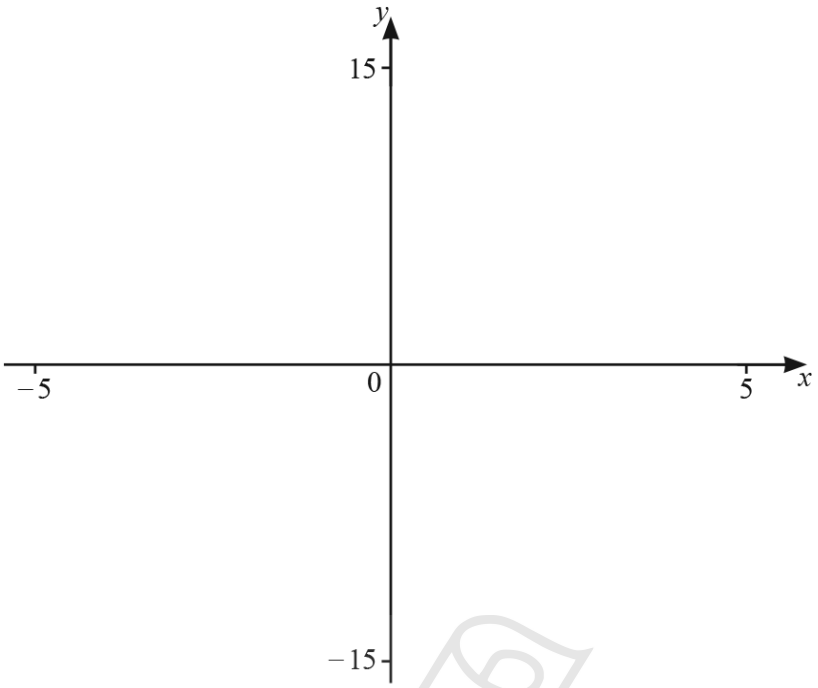
(b) Solve.

$$6x - 1 = \frac{5+x}{2x+3}$$

You must show all your working.

$x =$ ..... or $x =$ ..... [5]

22. 0607_s21_qp_42 Q: 4



$f(x) = |10 - x^2|$

(a) On the diagram, sketch the graph of $y = f(x)$ for $-5 \leqslant x \leqslant 5$. [2]

(b) Solve the equation $f(x) = 6$.

..... [2]

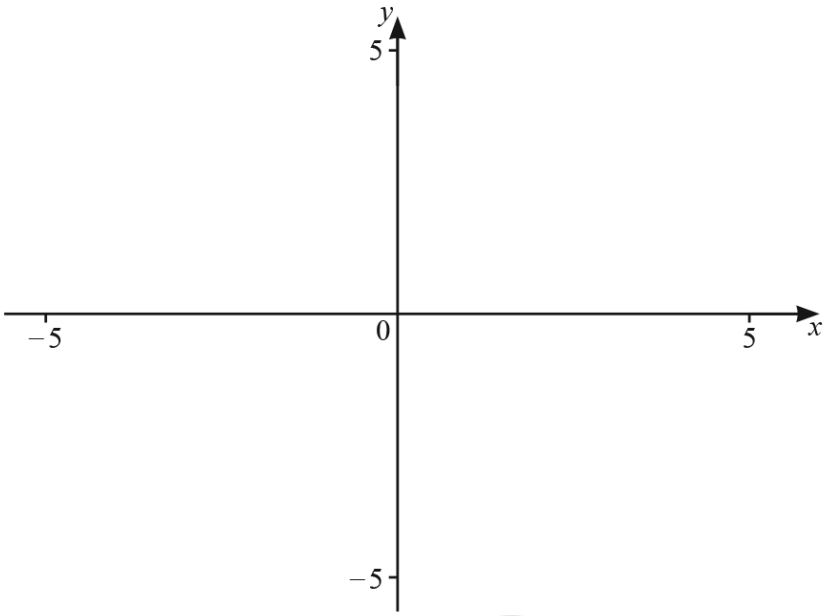
(c) Solve $f(x) > 6$.

..... [3]

(d) Find the values of k for which $f(x) = k$ has exactly two solutions.

..... [2]

23. 0607_s21_qp_42 Q: 13



$$f(x) = \frac{x^2 + 3}{(1 - x)(x + 3)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -5 and 5. [3]

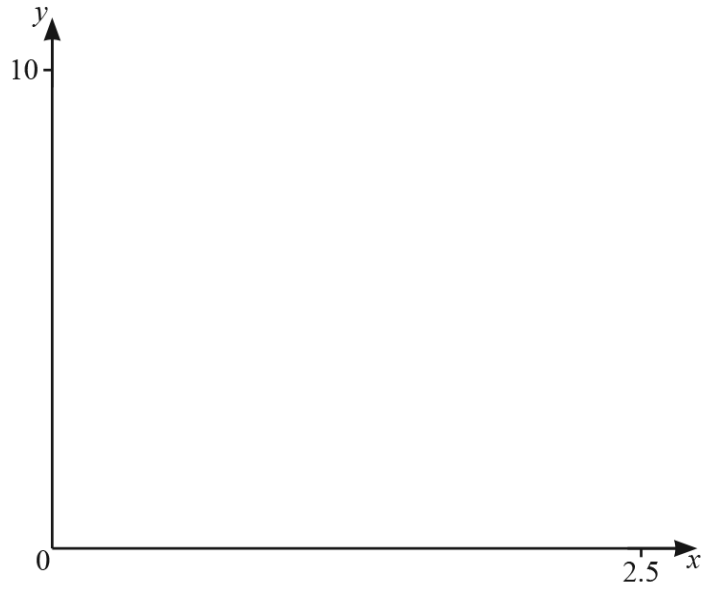
(b) Find the equations of the asymptotes parallel to the y-axis.

..... [2]

(c) Solve $f(x) = 2x + 3$.

..... [3]

24. 0607_s21_qp_43 Q: 9



$f(x) = x^x, x > 0$

(a) On the diagram, sketch the graph of $y = f(x)$ for $0 < x \leqslant 2.5$. [2]

(b) Find the coordinates of the local minimum point.

(..... , ...) [2]

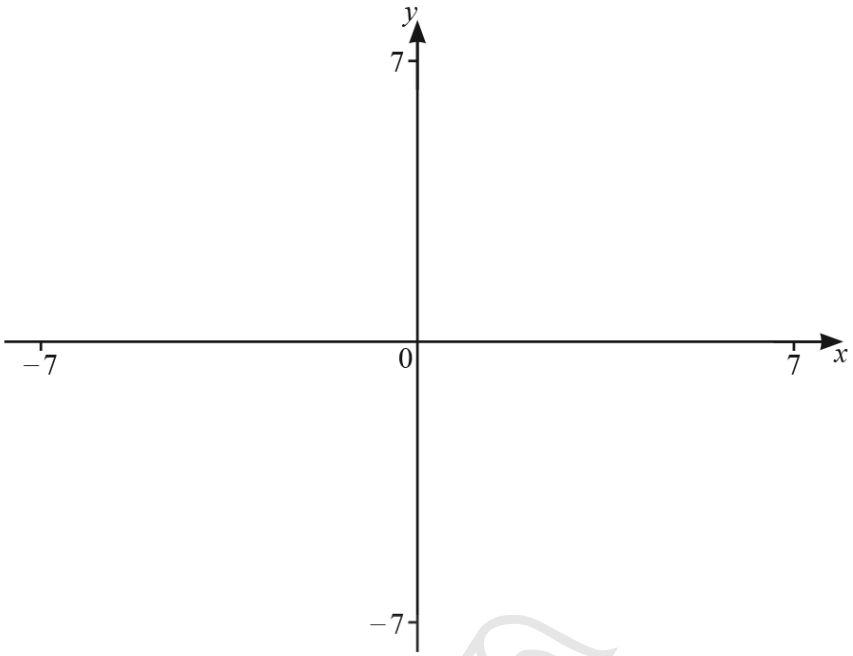
(c) **(i)** Find x when $f(x) = 3x$.

..... [3]

(ii) Solve $f(x) \geqslant 3x$.

..... [2]

25. 0607_w21_qp_41 Q: 5



$$f(x) = \frac{(2x^2+3)}{(x+1)(2-x)} \quad \text{for } -7 \leqslant x \leqslant 7$$

(a) On the diagram, sketch the graph of $y = f(x)$. [3]

(b) Write down the equation of each asymptote parallel to the y-axis.

..... [2]

(c) Write down the coordinates of the local minimum.

(..... , ...) [2]

(d) Find the range of values of x for which the gradient of $f(x)$ is negative.

..... [3]

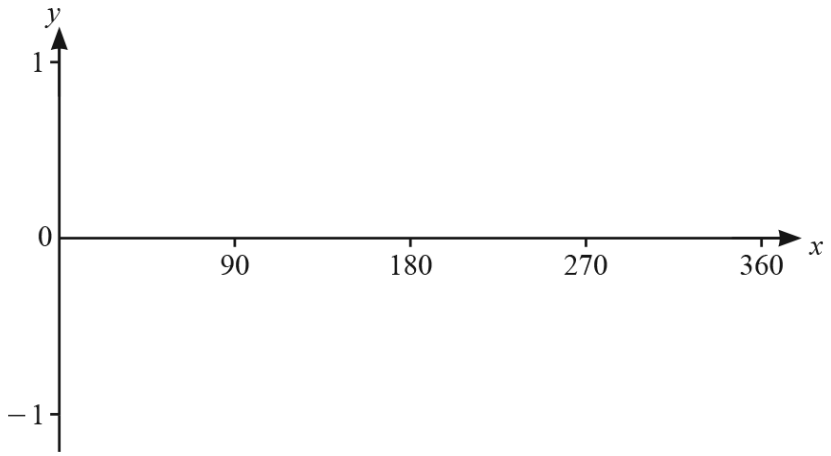
(e) Solve $f(x) = -x$.

$x =$ ..... [1]

26. 0607_w21_qp_42 Q: 2

$f(x) = \sin x$ for $0° \leqslant x \leqslant 360°$

$g(x) = (\sin x)^2$ for $0° \leqslant x \leqslant 360°$



(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Write down the coordinates of the local minimum point on the graph of $y = f(x)$.

(..... , ...) [1]

(c) Write down the period and amplitude of the graph of $y = f(x)$.

Period = ...

Amplitude = ... [2]

(d) On the same diagram, sketch the graph of $y = g(x)$. [2]

(e) Write down the range of

(i) $f(x)$,

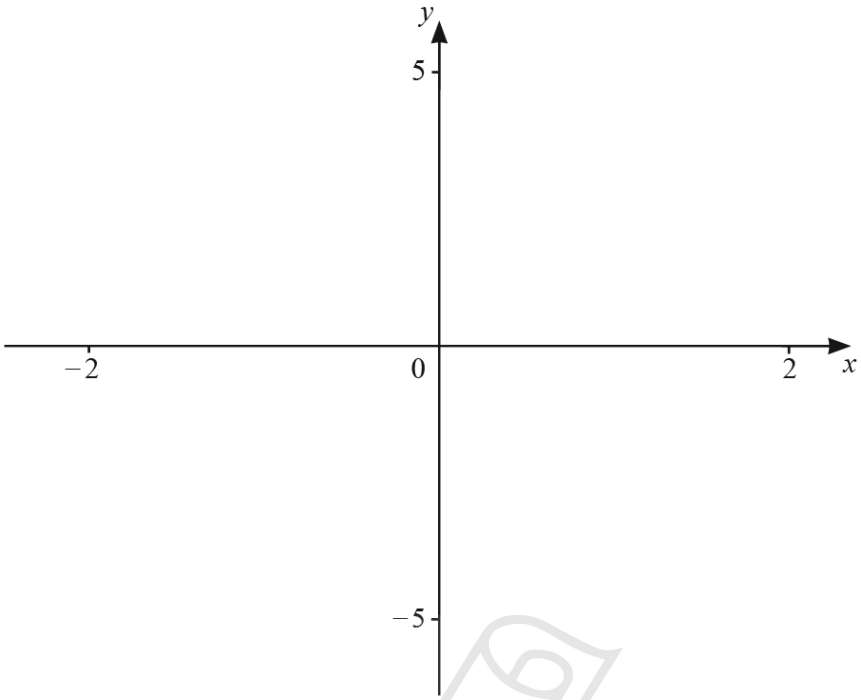
..... [1]

(ii) $g(x)$.

..... [1]

(f) On the diagram, shade the regions where $\sin x \geqslant (\sin x)^2$. [1]

27. 0607_w21_qp_43 Q: 8



$f(x) = 3x - x^3$ for $-2 \leqslant x \leqslant 2$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the coordinates of the local maximum.

(..... , ...) [1]

(c) Write down the x-coordinates of the points where the curve meets the x-axis.

$x =$ ..... , $x =$ ..... , $x =$ ..... [2]

(d) **(i)** Describe fully the **single** transformation that maps $y = f(x)$ onto $y = f(x+1)$.

.....

..... [2]

(ii) Solve $f(x) = f(x+1)$ for $-2 \leqslant x \leqslant 2$.

..... [2]

(iii) Solve $f(x) \geqslant f(x+1)$ for $-2 \leqslant x \leqslant 2$.

..... [2]

28. 0607_s20_qp_41 Q: 9

$f(x) = x^3 - 6x^2 + 8x \quad \text{for} \quad -0.5 \leqslant x \leqslant 4.5$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

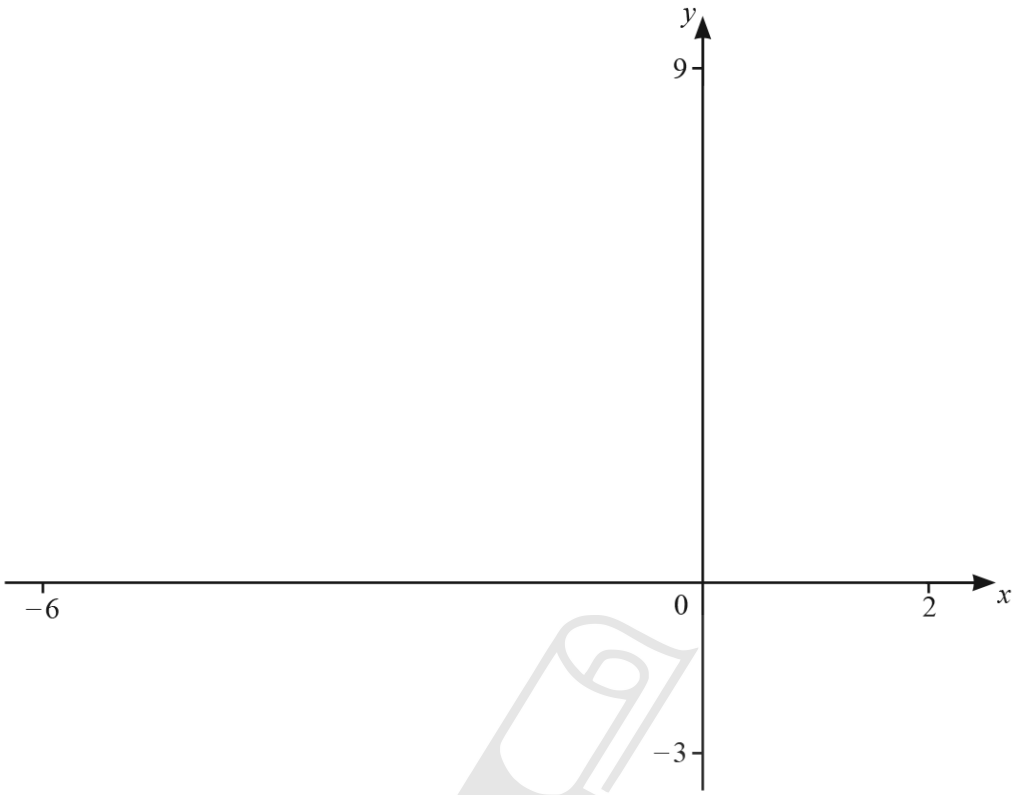
(b) Solve the inequality $f(x) < 0$.

..... [3]

(c) Find the positive value of k when $f(x) = k$ has two different solutions.

$k =$ ..... [2]

29. 0607_s20_qp_42 Q: 7



(a) $f(x) = 2 + \frac{1}{x+2}$

(i) On the diagram, sketch the graph of $y = f(x)$ for values of x between -6 and 2. [2]

(ii) Write down the coordinates of the points where the graph crosses the axes.

(..... , ...) and (..... , ...) [2]

(iii) Write down the equations of the asymptotes of the graph.

..... , ... [2]

(b) $g(x) = (x+4)^2$

On the diagram, sketch the graph of $y = g(x)$ for $-6 \leqslant x \leqslant -1$. [2]

(c) Solve the equation.

$f(x) = g(x)$

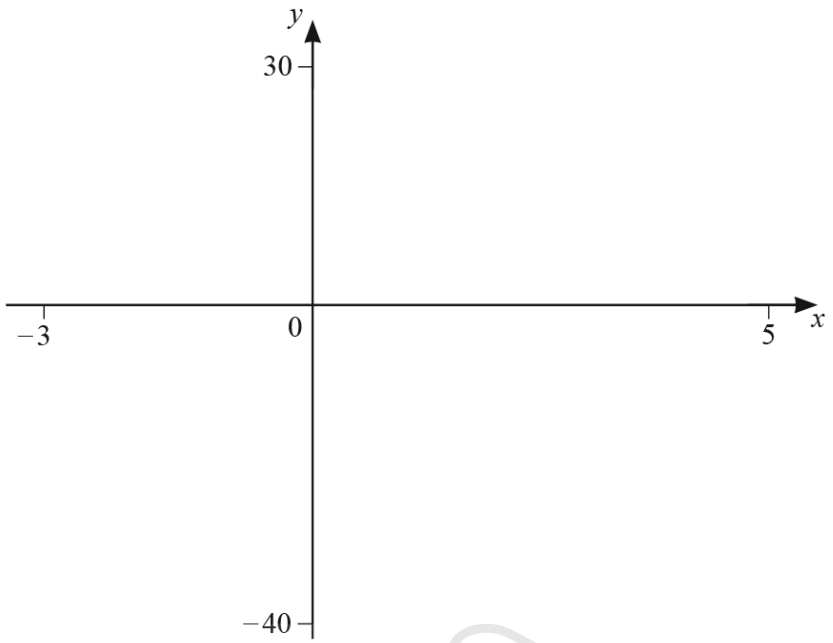
..... [3]

(d) Solve the inequality.

$f(x) \geqslant g(x)$

..... [2]

30. 0607_s20_qp_43 Q: 4



$f(x) = x^3 - 4x^2 - 3x + 18$

(a) On the diagram, sketch the graph of $y = f(x)$ for $-3 \leqslant x \leqslant 5$. [2]

(b) Solve the equation $f(x) = 10$.

$x =$ ..... , or $x =$ ..... , or $x =$ ..... [3]

(c) Write down the coordinates of

(i) the local maximum,

(..... , ...) [2]

(ii) the local minimum.

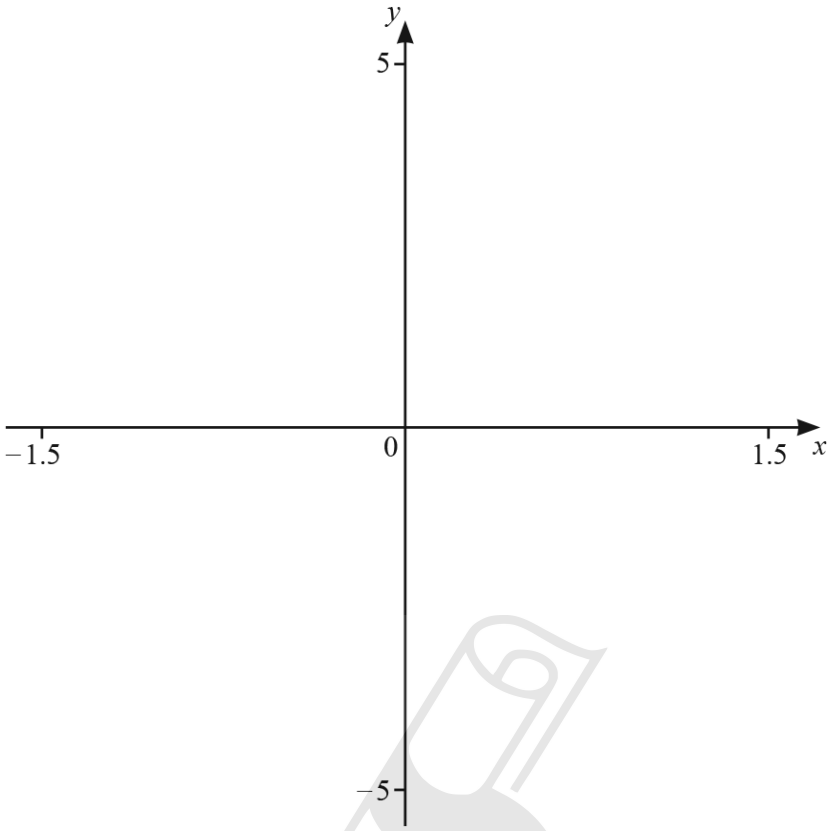
(..... , ...) [1]

(d) $f(x) = k$ has only 1 solution.

Find the ranges of values of k.

..... [2]

31. 0607_w20_qp_41 Q: 7



$f(x) = \left| x^3 - \frac{1}{x} \right|$

(a) On the diagram, sketch the graph of $y = f(x)$, for values of x between -1.5 and 1.5. [3]

(b) Write down the equation of the asymptote of the graph.

..... [1]

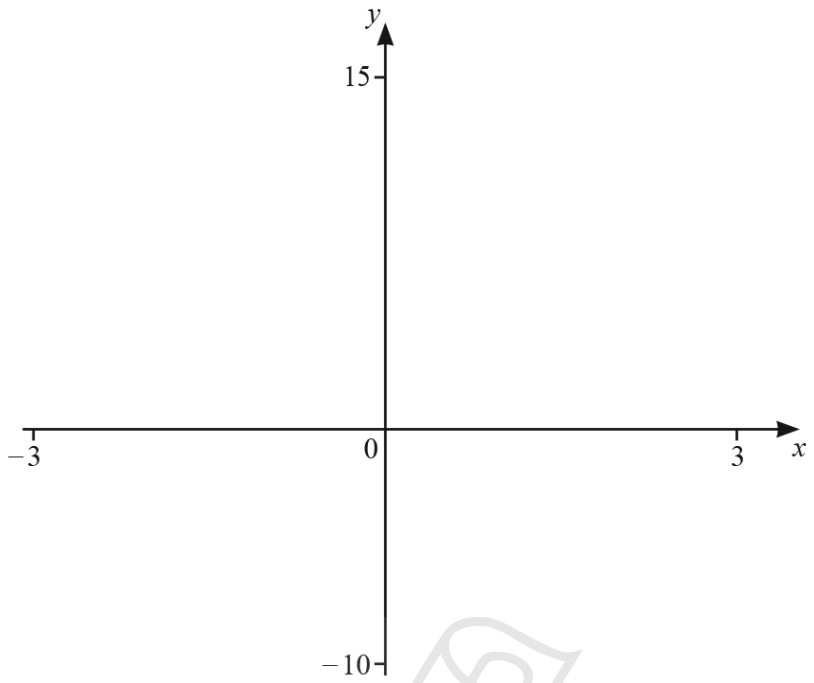
(c) Solve the equation $f(x) = 2$ for values of x between -1.5 and 0.

$x =$ ..... or $x =$ ..... [2]

(d) Solve the inequality $f(x) + x^2 \leqslant 2$ for values of x between -1.5 and 1.5.

..... [3]

32. 0607_w20_qp_42 Q: 4



$f(x) = x^3 - 5x + 3$ for $-3 \leqslant x \leqslant 3$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the coordinates of the local minimum point.

(..... , ...) [2]

(c) Describe fully the symmetry of the diagram.

.....

..... [3]

(d) $g(x) = 2x - 1$

(i) Solve $f(x) = g(x)$ for $-3 \leqslant x \leqslant 3$.

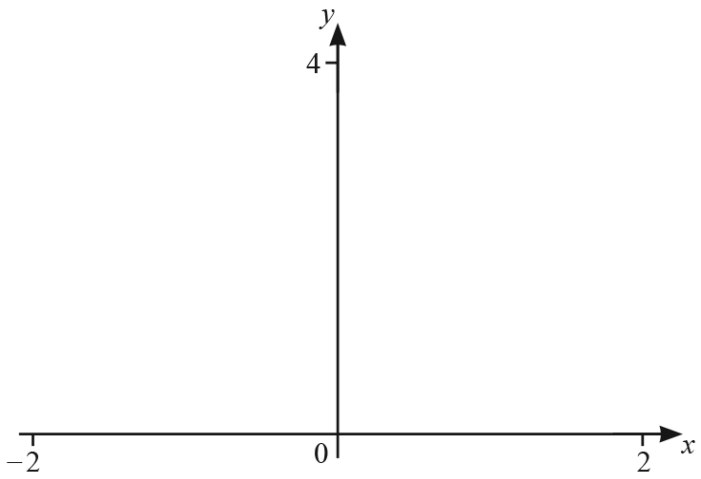
..... , ... , ... [3]

(ii) Use your answers to **part(i)** to solve $f(x) > g(x)$.

..... [2]

33. 0607_w20_qp_43 Q: 8

(a)



(i) On the diagram, sketch the graph of $y = 1.5^{-x}$ for $-2 \leqslant x \leqslant 2$. [2]

(ii) Solve the inequality $0.5 \leqslant 1.5^{-x} \leqslant 1$.

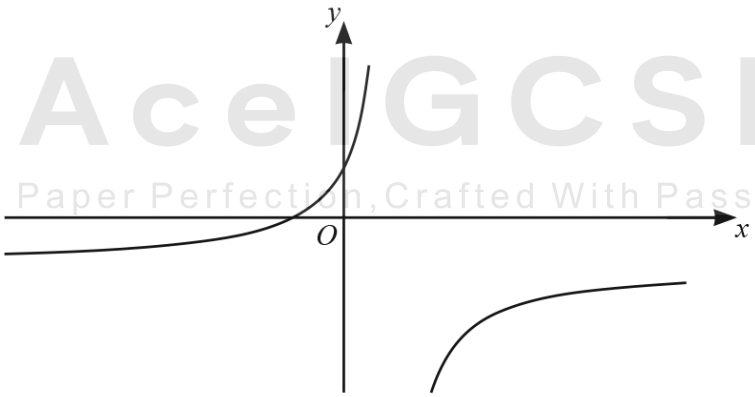
..... [3]

(iii) Solve the equation $1.5^{-x} = x^2$ for $-2 \leqslant x \leqslant 2$.

..... [3]

(iv) On your diagram shade the regions where $1.5^{-x} < x^2$ for $-2 \leqslant x \leqslant 2$. [1]

(b)



The diagram shows a sketch of the graph of $y = \dfrac{-2x+b}{x+a}$.

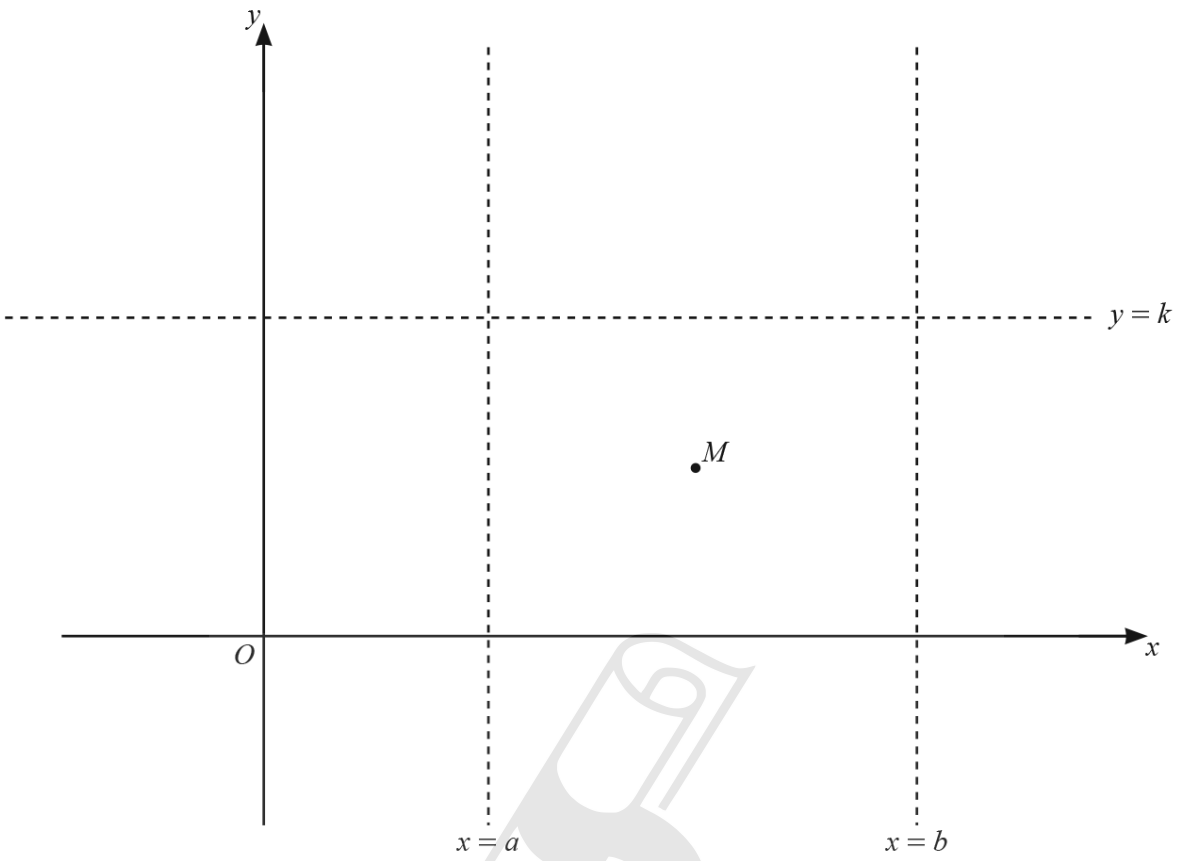
The asymptotes of the graph are $x = 2$ and $y = -2$.
The graph passes through the point (0, 2).

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [3]

(c)

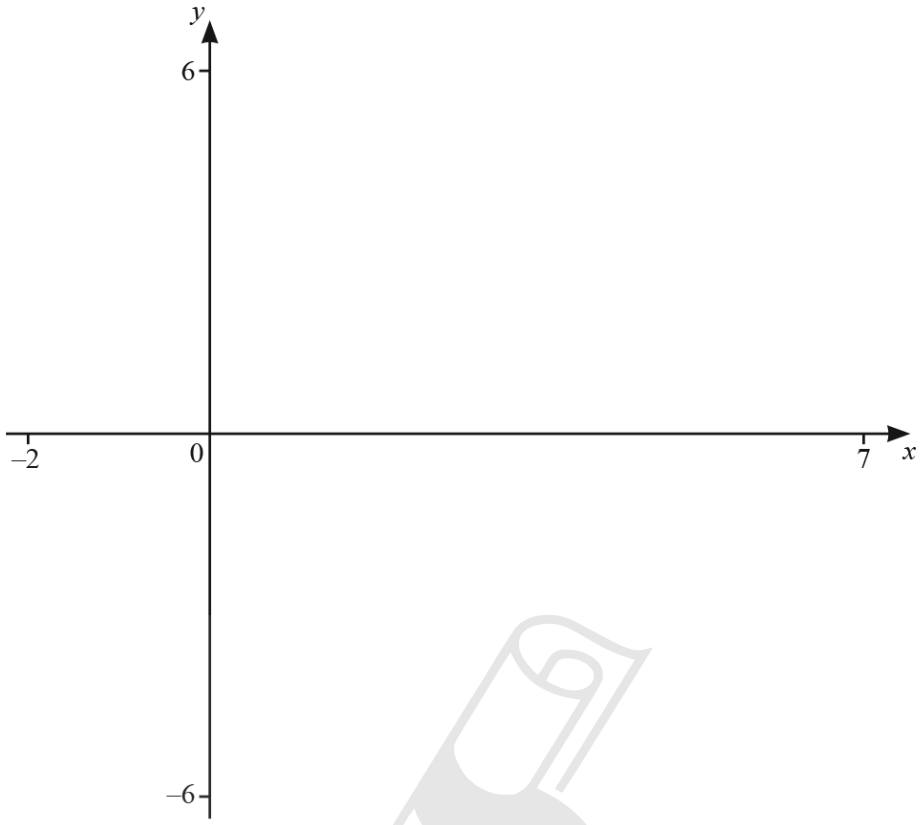


f(x) is a function such that

- the asymptotes of the graph are $x = a$, $x = b$ and $y = k$
- when $x < a$, the gradient of the graph is positive
- when $x > b$, the gradient of the graph is negative
- M is the only local maximum point
- the graph does not cross any asymptote.

On the diagram sketch the graph of $y = \text{f}(x)$. [3]

34. 0607_s19_qp_41 Q: 11



$$f(x) = \frac{(x+2)}{(x-1)(x-4)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -2 and 7. [3]

(b) Write down the co-ordinates of the local maximum.

(....., ...) [2]

(c) Write down the equation of each of the three asymptotes.

....., ..., ... [3]

(d) $g(x) = x - 5$

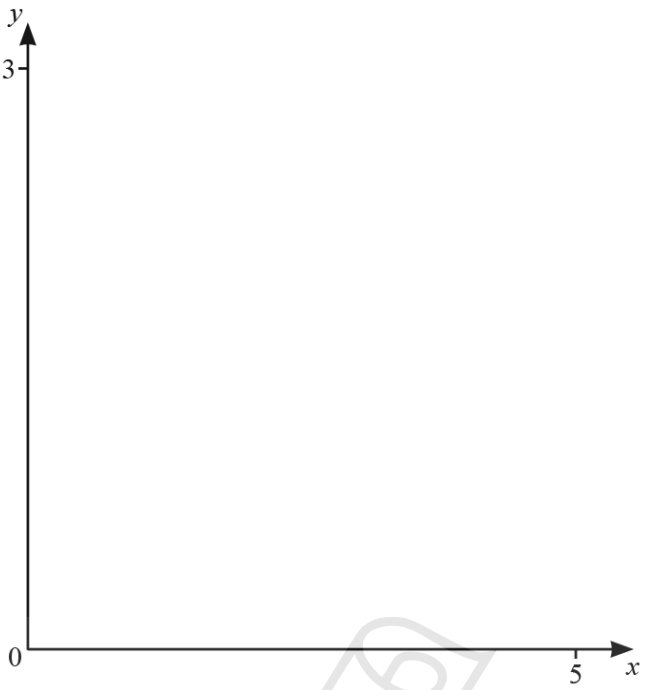
(i) Solve the equation $f(x) = g(x)$.

$x =$ ..... or $x =$ ..... or $x =$ ..... [3]

(ii) Solve the inequality $f(x) > g(x)$.

..... [3]

35. 0607_s19_qp_42 Q: 2



(a) On the diagram, sketch the graph of $y = \log\left(\frac{x+1}{x}\right)$ for $0 < x \leqslant 5$. [2]

(b) Write down the equations of the asymptotes to the graph of $y = \log\left(\frac{x+1}{x}\right)$.

..... [2]

(c) Solve the equation $\log\left(\frac{x+1}{x}\right) = 0.5$.

$x =$ ..... [1]

(d) On the same diagram, sketch the graph of $y = \frac{x}{2}$ for $0 < x \leqslant 5$. [1]

(e) Solve the equation $\log\left(\frac{x+1}{x}\right) = \frac{x}{2}$.

$x =$ ..... [1]

(f) On your diagram, shade the region where $y \leqslant 0.5$, $y \geqslant \frac{x}{2}$ and $y \geqslant \log\left(\frac{x+1}{x}\right)$. [1]

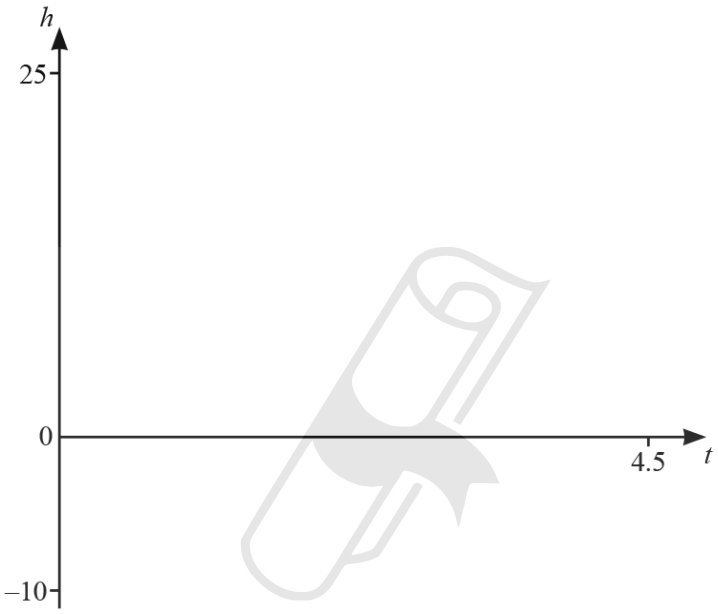
36. 0607_s19_qp_42 Q: 7

A stone is thrown vertically upwards from ground level.
Its height, h metres above ground level, after t seconds, is given by $h = 20t - 4.9t^2$.

(a) Find the height of the stone after 1 second.

..... m [1]

(b) **(i)** On the diagram, sketch the graph of $h = 20t - 4.9t^2$ for $0 \leqslant t \leqslant 4.5$.



[2]

(ii) Complete the statement.

The maximum height reached by the stone is ..... m when t = ... s. [2]

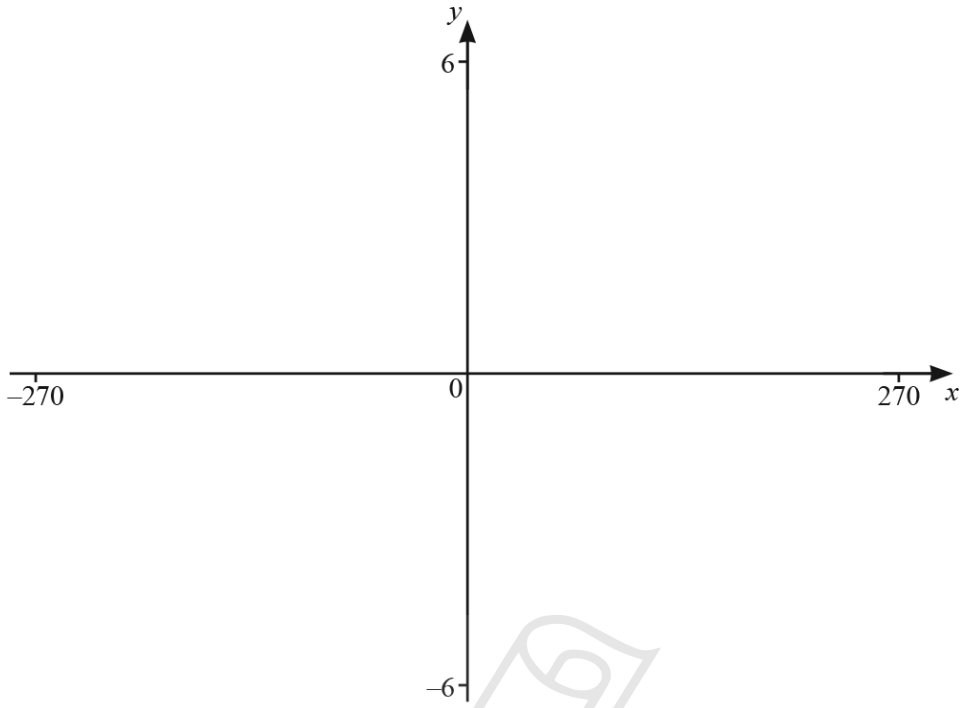
(iii) Find the length of time the stone is in the air before it hits the ground.

..... s [1]

(iv) Find the length of time the stone is more than 18 m above ground level.

..... s [3]

37. 0607_s19_qp_43 Q: 4



(a) On the diagram, sketch the graph of $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = \frac{1}{\cos x} \quad \text{for values of } x \text{ between } -270 \text{ and } 270 \text{ .}$$

[3]

(b) Write down the range of $\mathrm{f}(x)$.

..... [2]

(c) **(i)** On the same diagram, sketch the graph of $y = \mathrm{g}(x)$ where

$$\mathrm{g}(x) = \frac{(720 + x)}{2x} \quad \text{for values of } x \text{ between } -270 \text{ and } 270 \text{ .}$$

[2]

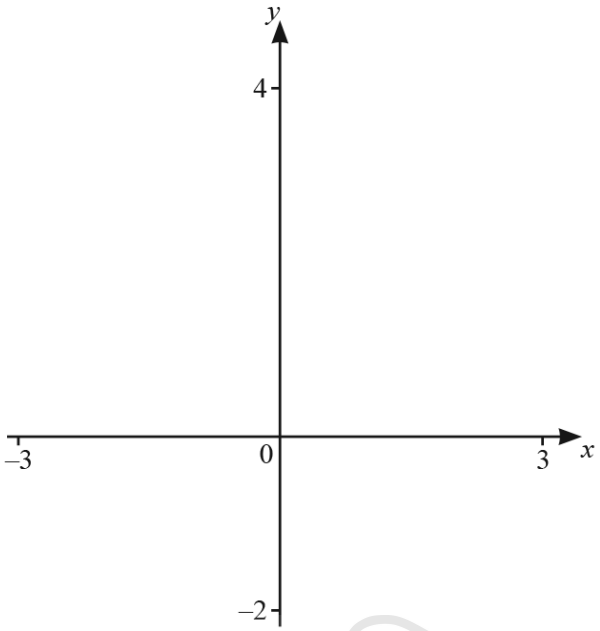
(ii) Find the values of the x co-ordinates of the points of intersection of the two graphs.

$x =$ ..... or $x =$ ..... or $x =$ ..... [3]

(iii) Find the equation of each asymptote of the graph of $y = \mathrm{g}(x)$.

..... [2]

38. 0607_w19_qp_41 Q: 3



$f(x) = \frac{1}{(1-x^3)}, \quad x \neq 1$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -3 and 3. [3]

(b) Write down the range of $f(x)$ for $-3 \leqslant x \leqslant 0$.

..... [2]

(c) On the same diagram, sketch the graph of $y = x^2$ for $-2 \leqslant x \leqslant 2$. [1]

(d) **(i)** Solve the equation $\frac{1}{1-x^3} = x^2$.

$x =$ ..... [1]

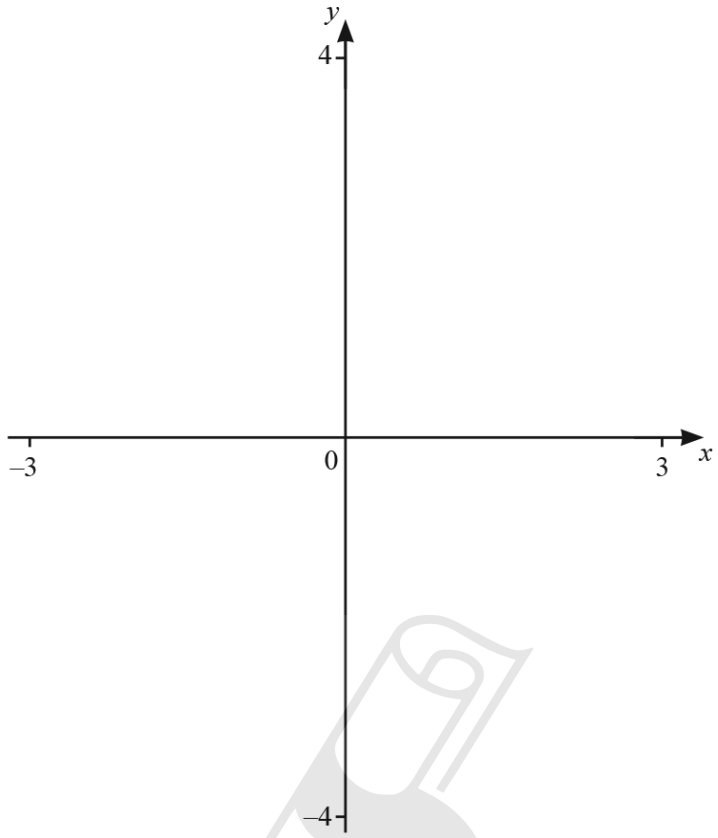
(ii) The equation $\frac{1}{1-x^3} = x^2$ can be written in the form $x^u - x^w + 1 = 0$.

Find the value of u and the value of w.

$u =$ .....

$w =$ ..... [2]

39. 0607_w19_qp_42 Q: 12



(a) On the diagram, sketch the graph of $y = f(x)$, where

$$f(x) = \frac{1}{x(x-1)(x+1)} \quad \text{for values of } x \text{ between } -3 \text{ and } 3.$$

[4]

(b) Write down the equations of the asymptotes.

..... , ... , ... [3]

(c) Write down the co-ordinates of the local maximum.

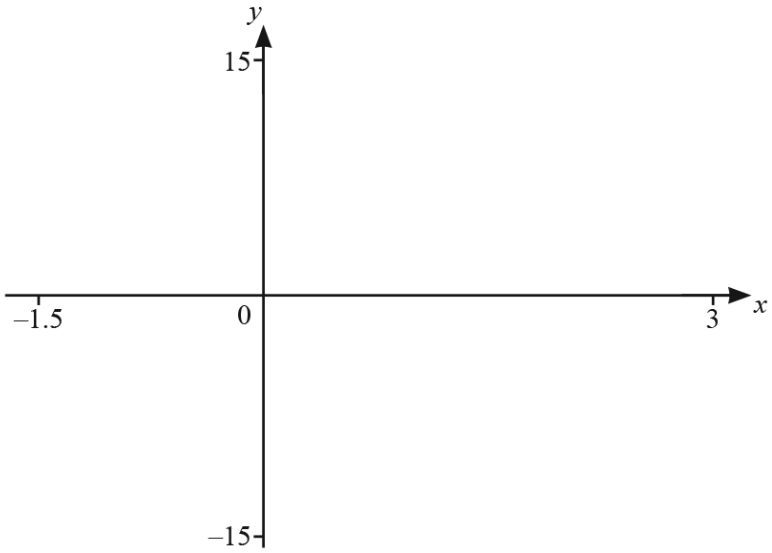
(..... , ...) [2]

(d) The line $y = 2x + 1$ intersects the curve $y = f(x)$ twice.

Find the value of the x co-ordinate of each point of intersection.

$x =$ ..... or $x =$ ..... [2]

40. 0607_w19_qp_43 Q: 3



$f(x) = 2x^3 - 5x^2 + 3$ for $-1.5 \leqslant x \leqslant 3$

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Find the zeros of $f(x)$.

..... [3]

(c) Find the co-ordinates of the local maximum.

(..... , ...) [1]

(d) Find the co-ordinates of the local minimum.

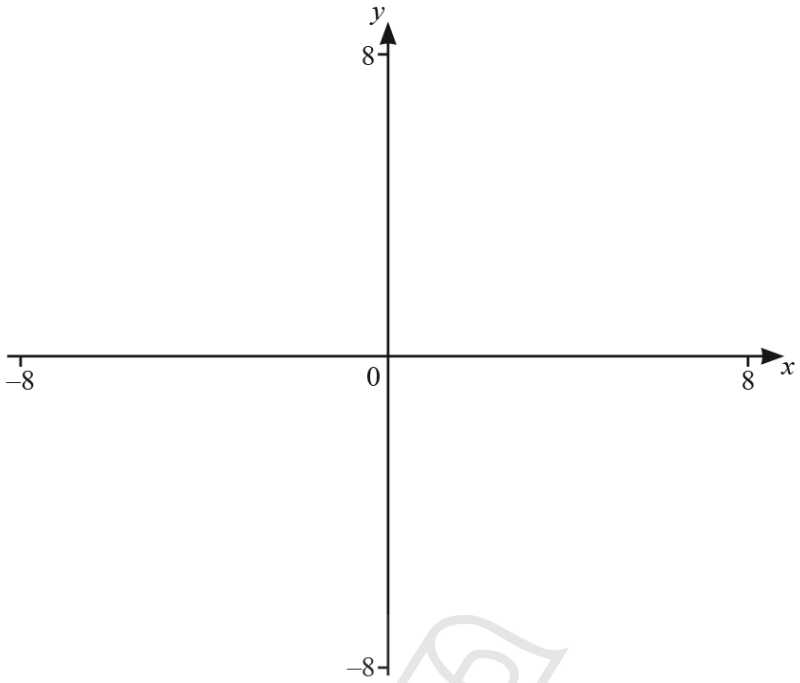
(..... , ...) [2]

(e) The equation $2x^3 - 5x^2 + 3 = k$ has three solutions.

Find the range of values of k.

..... [2]

41. 0607_w19_qp_43 Q: 12



$$f(x) = \frac{3x+2}{(x+2)(x-3)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -8 and 8. [3]

(b) Write down the equations of the asymptotes.

..... , ... , ... [3]

(c) $g(x) = x - 2$

(i) On the diagram, sketch the graph of $y = g(x)$ for $-6 \leqslant x \leqslant 8$. [1]

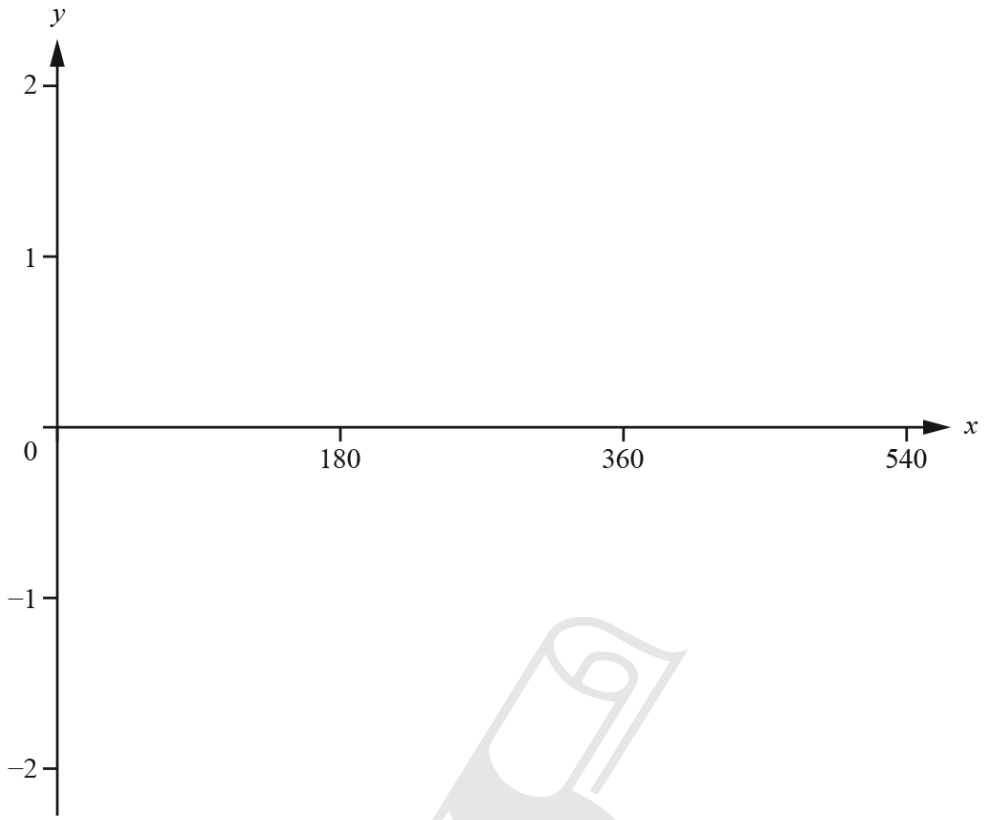
(ii) Solve $f(x) = g(x)$.

$x =$ ..... or $x =$ ..... or $x =$ ..... [3]

(iii) Solve $f(x) > g(x)$.

..... [3]

42. 0607_s18_qp_41 Q: 5



$f(x) = \sin x^\circ$ $\quad$ $g(x) = \log\left(\frac{1}{\sin x^\circ}\right)$

(a) (i) On the diagram, sketch the graph of $y = f(x)$ for $0 \leqslant x \leqslant 540$. [2]

(ii) Write down the range of $f(x)$ for $0 \leqslant x \leqslant 540$.

..... [1]

(b) (i) On the same diagram, sketch the graph of $y = g(x)$ for values of x between 0 and 540. [2]

(ii) Give a reason why there are no values of $g(x)$ for $180 \leqslant x \leqslant 360$.

..... [1]

(iii) Write down the co-ordinates of the minimum points on the graph of $y = g(x)$.

(..... , ...) and (..... , ...) [2]

(iv) Write down the equations of the four asymptotes to the graph of $y = g(x)$.

..... , ... , ... , ... [2]

(c) **(i)** $f(k) = g(k)$ and $0 \leqslant k \leqslant 90$.

Find the value of k.

$k =$ ..... [1]

(ii) Solve the inequality $f(x) > g(x)$ for values of x between 0 and 540.

..... [2]

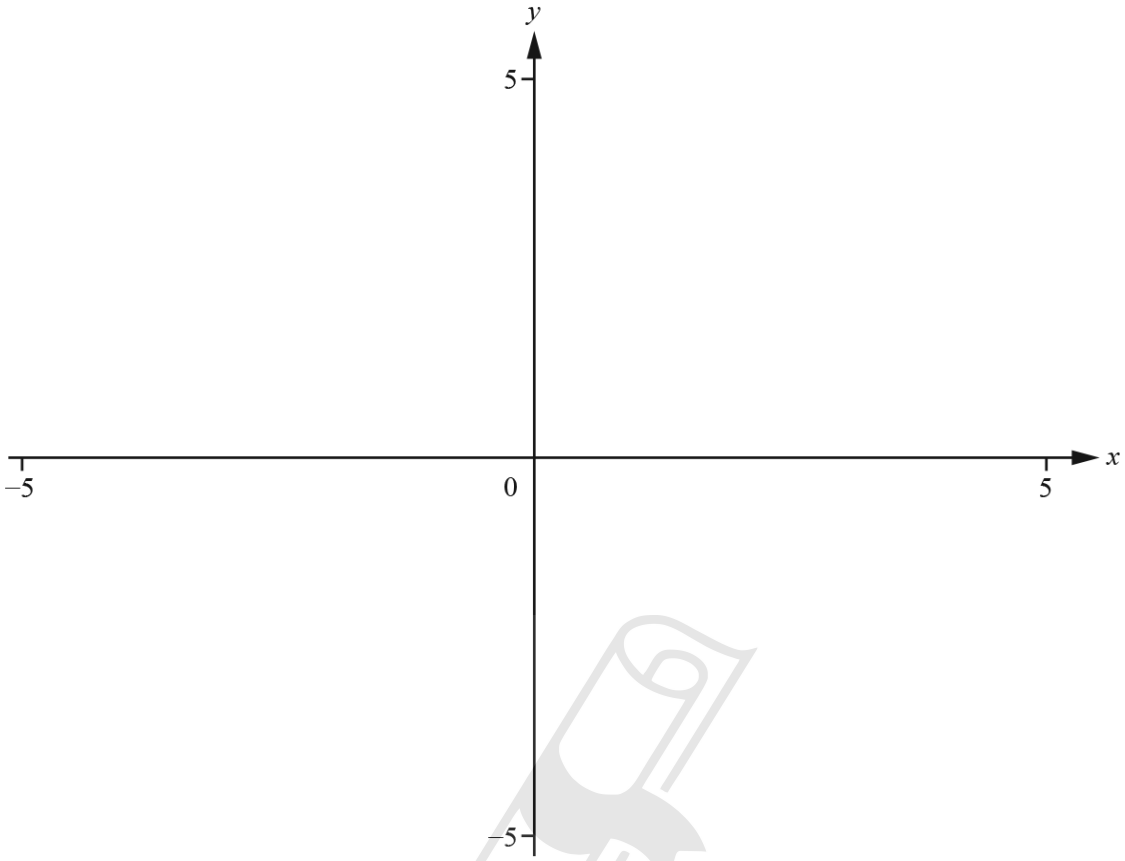
(iii) j is an integer.

The equation $f(x) = j$ has no solutions.
The equation $g(x) = j$ has no solutions.

Write down a possible value of j.

$j =$ ..... [1]

43. 0607_s18_qp_42 Q: 2



$f(x) = 1 - \dfrac{x}{(x^2 - 9)}$

(a) On the diagram, sketch the graph of $y = f(x)$, for values of x between -5 and 5. [3]

(b) Write down the equations of the three asymptotes.

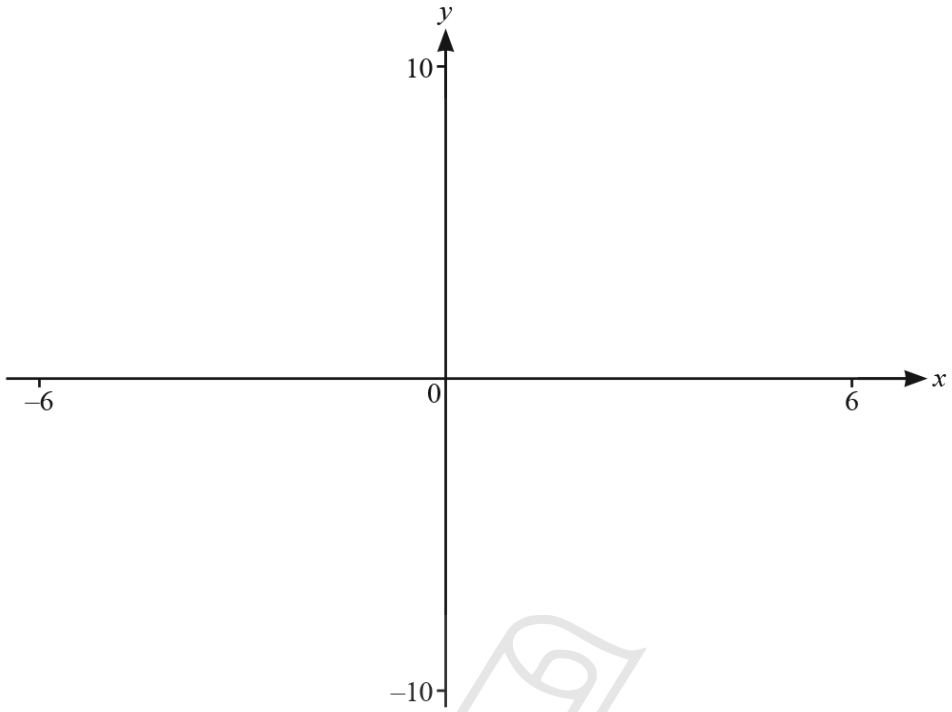
....., ..., ... [3]

(c) The line $y = x$ intersects the curve $y = 1 - \dfrac{x}{(x^2 - 9)}$ three times.

Find the values of the x co-ordinates of the points of intersection.

$x =$ ..... or $x =$ ..... or $x =$ ..... [3]

44. 0607_s18_qp_43 Q: 5



$$f(x) = \frac{(2x^2 - x + 5)}{(x^2 + x - 6)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -6 and 6. [3]

(b) Find the co-ordinates of the local maximum.

(..... , ...) [2]

(c) Find the equations of the three asymptotes to the graph of $y = f(x)$.

..... , ... , ... [3]

(d) The equation $f(x) = k$ has no solutions.

Find the range of values of k.

..... [2]

(e) $g(x) = |x+1|$

(i) Solve $f(x) = g(x)$.

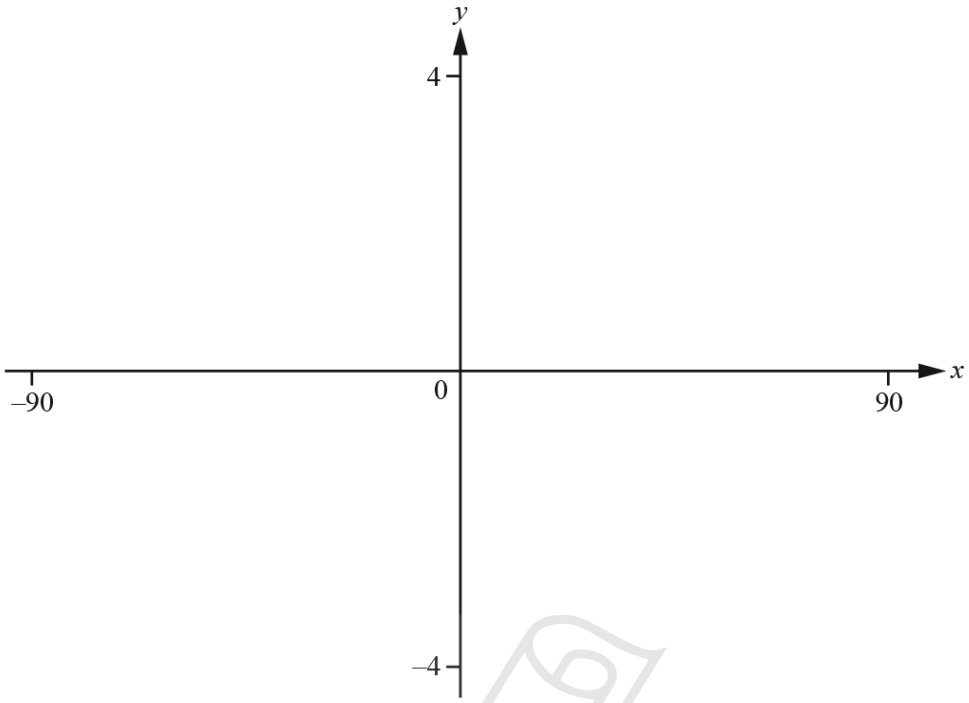
$x =$ ..... or $x =$ ..... [2]

(ii) Solve the inequality $f(x) > g(x)$.

..... [2]

---

45. 0607_w18_qp_41 Q: 3



$f(x) = 1 - 2\sin(2x - 10)^\circ$

(a) On the diagram sketch the graph of $y = f(x)$, for $-90 \leqslant x \leqslant 90$.

[3]

(b) Write down the co-ordinates of the x-intercepts.

(..... , ...)

(..... , ...) [2]

(c) Write down the co-ordinates of the local maximum.

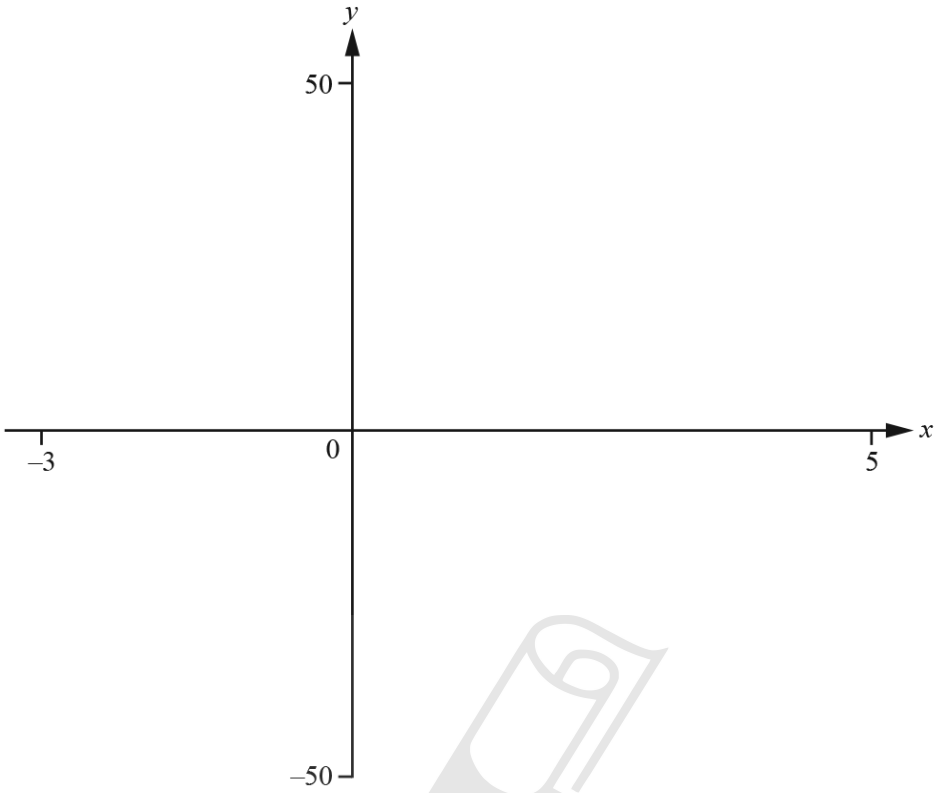
(..... , ...) [1]

(d) The graph of $y = -\frac{x}{60}$ intersects the graph of $y = 1 - 2\sin(2x - 10)^\circ$ three times.

Find the value of the x co-ordinate at each point of intersection.

$x =$ ..... or $x =$ ..... or $x =$ ..... [3]

46. 0607_w18_qp_41 Q: 9



$f(x) = x^3 - 3x^2 - 4x + 1$ for $-3 \leqslant x \leqslant 5$.

(a) On the diagram, sketch the graph of $y = f(x)$. [2]

(b) Write down the co-ordinates of the local minimum.

(....., ...) [2]

(c) Find the range of values of k so that $f(x) = k$ has only one solution.

..... [2]

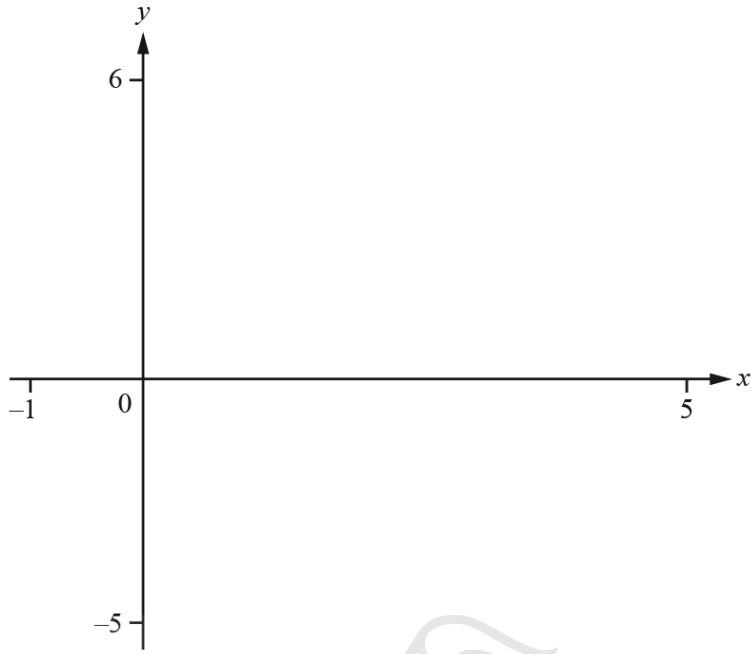
(d) $g(x) = 3x^2 - 6x - 4$ for $-3 \leqslant x \leqslant 5$.

The graph of $y = f(x)$ intersects the graph of $y = g(x)$ twice.

Solve $f(x) > g(x)$.

..... [2]

47. 0607_w18_qp_43 Q: 8



$f(x) = 1 + 4x - x^2$

(a) On the diagram, sketch the graph of $y = f(x)$ for $-1 \leqslant x \leqslant 5$. [2]

(b) Write down the equation of the line of symmetry of the graph of $y = f(x)$.

..... [1]

(c) **(i)** Find the zeros of $f(x)$.

..... [2]

(ii) Solve the inequality $f(x) > 0$.

..... [1]

(d) Solve the equation $f(x) + 1 = 0$.

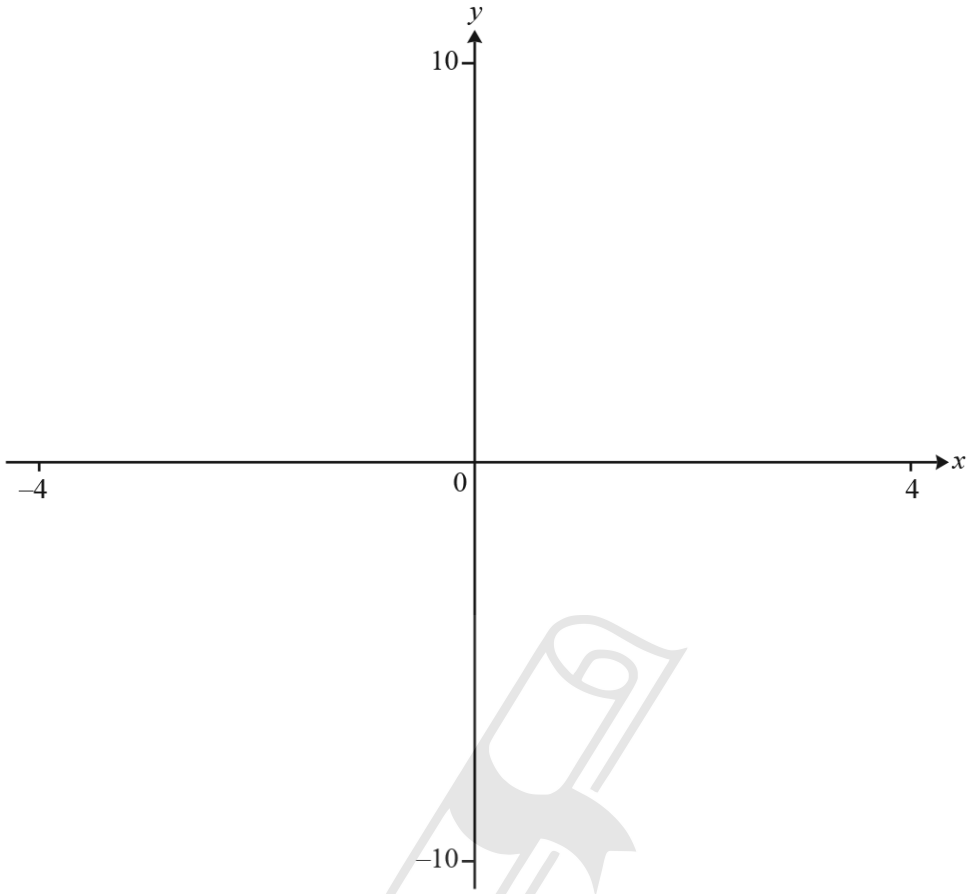
$x =$ ..... or $x =$ ..... [2]

(e) $g(x) = 5 - x$

On the diagram, sketch the graph of $y = g(x)$ for $-1 \leqslant x \leqslant 5$. [2]

(f) On the diagram, shade the region where $y \leqslant f(x)$ and $y \leqslant g(x)$. [1]

48. 0607_s17_qp_41 Q: 7



$f(x) = |9 - x^2|$

(a) On the diagram, sketch the graph of $y = f(x)$, for values of x between -4 and 4. [4]

(b) Solve $f(x) = 7$.

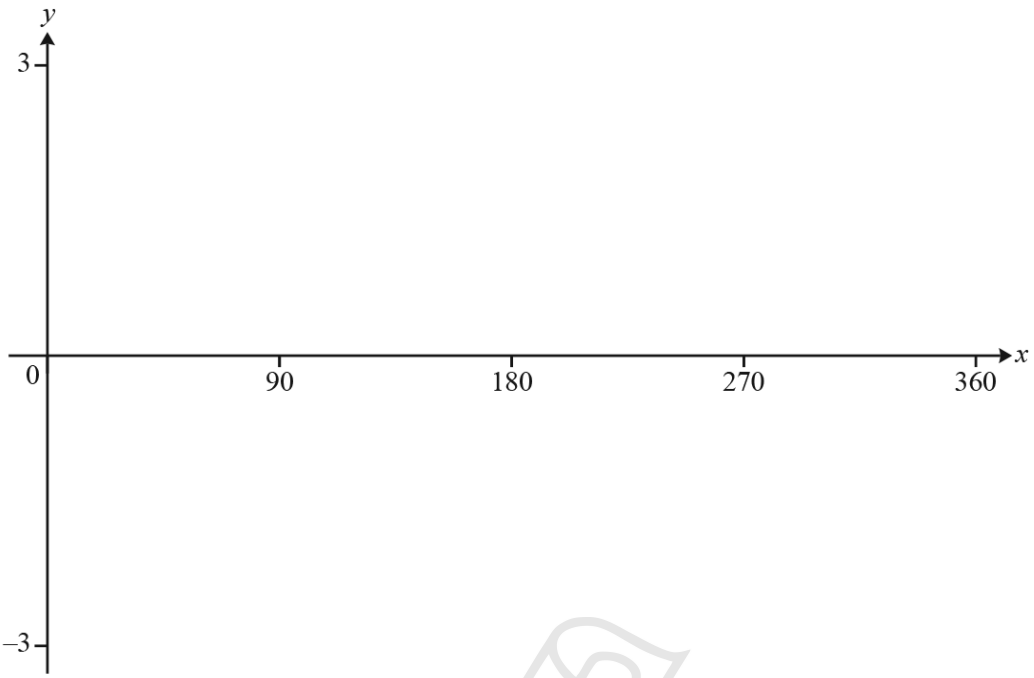
..... [2]

(c) The equation $|9 - x^2| = k$ has two solutions.

Find the range of values of k.

..... [2]

49. 0607_s17_qp_41 Q: 10



$f(x) = 2\sin x + \cos x$ for $0° \leqslant x \leqslant 360°$

$g(x) = 2 - \log x$ for $0° \leqslant x \leqslant 360°$

(a) On the diagram, sketch the graph of $y = f(x)$. [3]

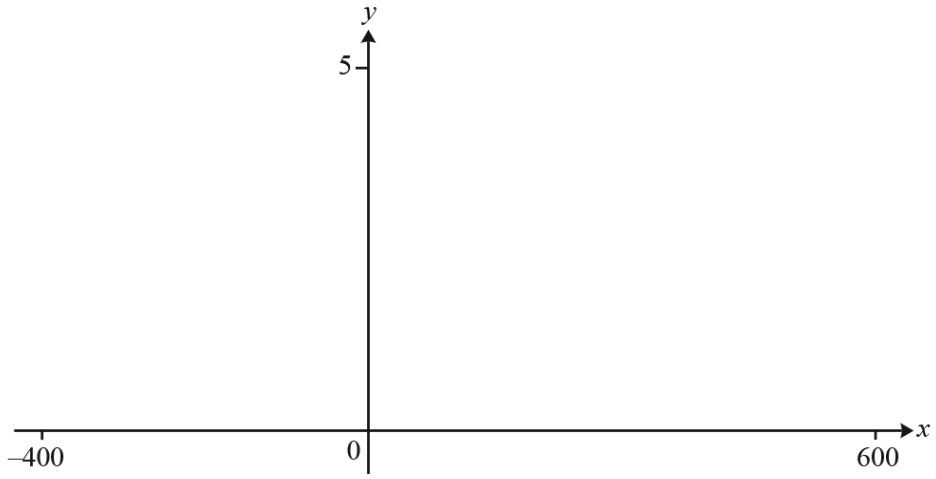
(b) On the same diagram, sketch the graph of $y = g(x)$. [2]

(c) Solve the equation.

$$2\sin x + \cos x = 2 - \log x$$

..... [3]

50. 0607_s17_qp_42 Q: 8



$f(x) = 3^{\sin x}$

(a) Sketch the graph of $y = f(x)$ for $-400° \leqslant x \leqslant 600°$. [3]

(b) Find the x co-ordinates of the local maximum points of $f(x)$ for $-400° \leqslant x \leqslant 600°$.

$x =$ ..... or $x =$ ..... or $x =$ ..... [3]

(c) The point $(30, \sqrt{3})$ is on the graph.
The point $(a, \sqrt{3})$ is also on the graph where $600° < a < 900°$.

Find the two possible values of a.

$a =$ ..... or $a =$ ..... [2]

(d) $g(x) = 3 - \frac{x}{100}$

Solve the inequality $g(x) > f(x)$.

..... [3]

51. 0607_s17_qp_43 Q: 6

$f(x) = x - 5\log x$

(a) On the diagram, sketch the graph of $y = f(x)$ for $0 < x \leqslant 10$. [2]

(b) Find the co-ordinates of the local minimum point.

(....., ...) [2]

(c) Find the range of $f(x)$ for the domain $1 \leqslant x \leqslant 5$.

..... [2]

(d) Solve the equation $f(x) = 2$.

$x =$ ..... or $x =$ ..... [2]

(e) Solve the inequality $f(x) < 2$.

..... [1]

(f) **(i)** Find f(0.001), f(0.000 01) and f(0.000 000 1).

f(0.001) = ... , f(0.000 01) = ..., f(0.000 000 1) = ... [1]

(ii) Complete the statement.

The y-axis is ..... to the graph of $y = f(x)$. [1]

52. 0607_w17_qp_41 Q: 10

(a) Make y the subject of $3x + y = 8$.

$y =$ ..... [1]

(b) The line $3x + y = 8$ intersects the curve $x^2 + y^2 = 25$ at two points.

(i) Use substitution to show that $10x^2 - 48x + 39 = 0$.

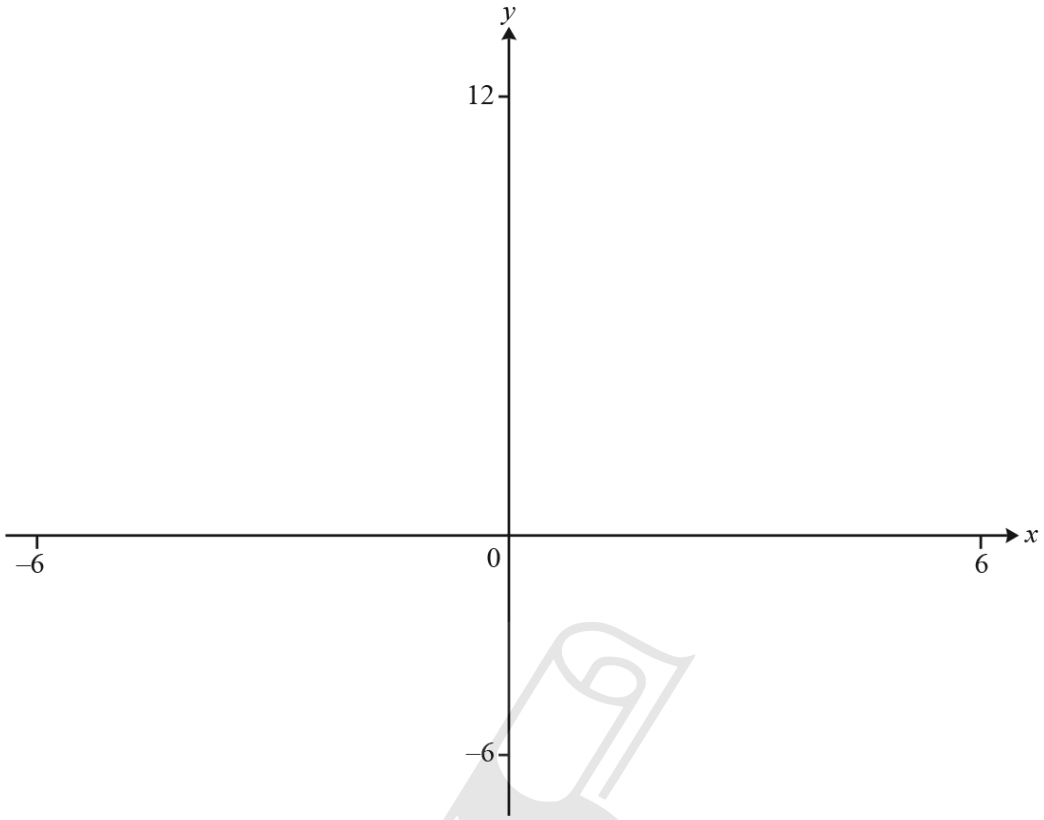
[3]

(ii) Solve the equation $10x^2 - 48x + 39 = 0$ and find the co-ordinates of the two points of intersection. Show all your working.

(..... , ...)

(..... , ...) [5]

53. 0607_w17_qp_41 Q: 11



$$f(x) = \frac{2x^2 + 3x}{(x+2)(3-x)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -6 and 6. [3]

(b) Find the co-ordinates of the local minimum.

(....., ...) [2]

(c) Find the equations of the two asymptotes that are parallel to the y-axis.

..... and ..... [2]

(d) $g(x) = 3x + 2$

Solve.

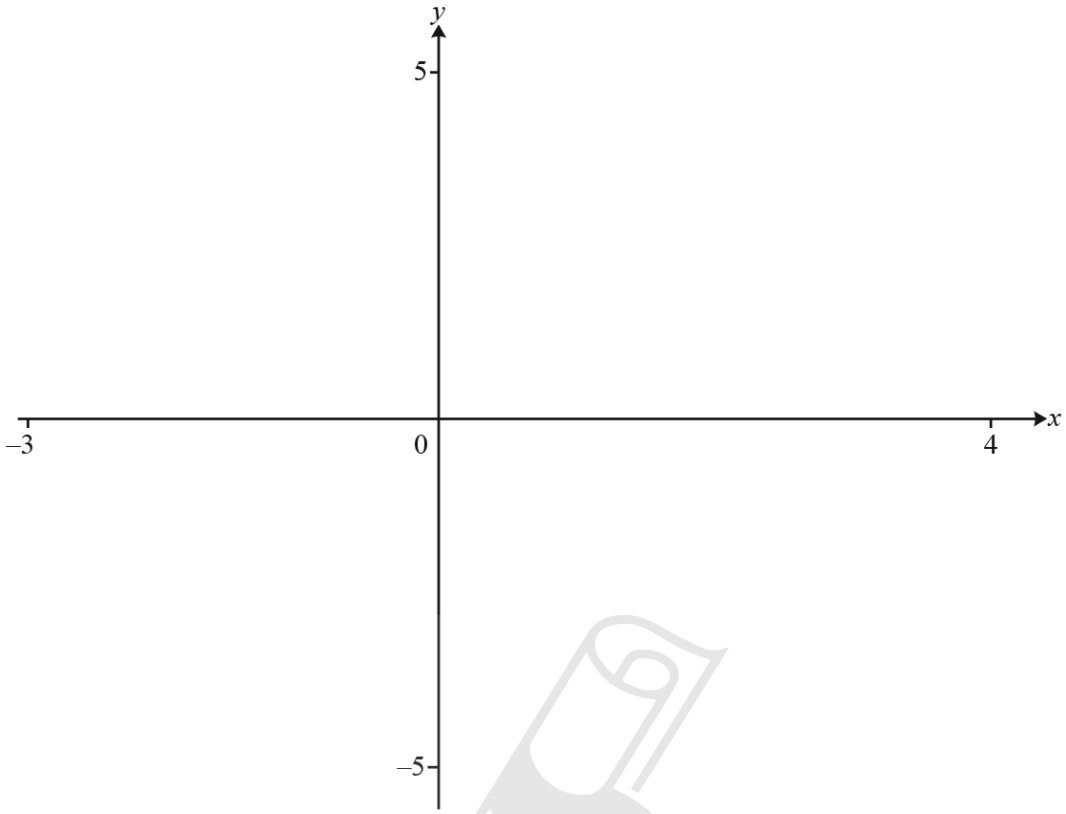
(i) $f(x) = g(x)$

..... [3]

(ii) $f(x) > g(x)$

..... [3]

54. 0607_w17_qp_42 Q: 4



$$f(x) = \frac{x}{(x^2 - x - 2)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x from –3 to 4. [3]

(b) Find the two values of x for which $f(x)$ does not exist.

..... , ... [2]

(c) When $k \neq 0$, write down the number of solutions to the equation $f(x) = k$.

..... [1]

(d) $g(x) = 2^{-x} + 1$

(i) On the diagram, sketch the graph of $y = g(x)$ for $-2 \leqslant x \leqslant 4$. [2]

(ii) Write down the equation of the asymptote to the graph of $y = g(x)$.

..... [1]

(e) Solve the equation $f(x) = g(x)$.

$x =$ ..... or $x =$ ..... [2]

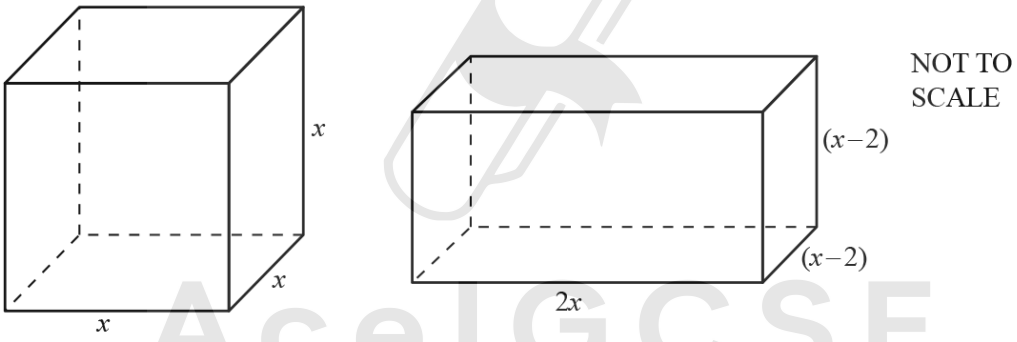
55. 0607_w17_qp_42 Q: 7

(a) Ali walks for 1 hour at x km/h and then for 2 hours at $\left(x+\frac{1}{4}\right)$ km/h.
He walks a total distance of 8 km.

Write an equation and solve it to find the value of x.

$x =$ ..... [3]

(b)

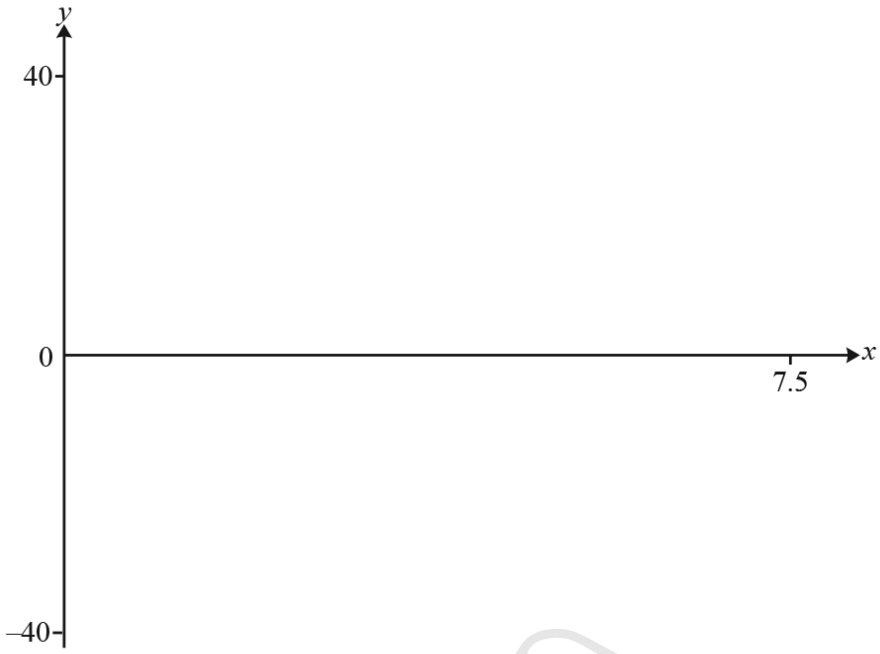


The volume of the cube is equal to the volume of the cuboid.

(i) Show that $x^3 - 8x^2 + 8x = 0$.

[3]

(ii)



On the diagram, sketch the graph of $y = x^3 - 8x^2 + 8x$ for $0 \leqslant x \leqslant 7.5$. [2]

(iii) Find the volume of the cuboid.

..... [2]

56. 0607_s16_qp_42 Q: 6

$f(x) = \sin(x^2)$ where x^2 is in degrees.

(a) On the diagram, sketch the graph of $y = f(x)$ for $0 \leqslant x \leqslant 20$. [2]

(b) One solution of the equation $f(x) = 0$, for $0 \leqslant x \leqslant 20$ is $x = 0$.

Find the other two solutions.

$x =$ ..... or $x =$ ..... [2]

(c) Find the co-ordinates of the local maximum point.

(..... , ...) [2]

(d) There is a local minimum point at (0, 0).

Find the co-ordinates of the other local minimum point when $0 \leqslant x \leqslant 20$.

(..... , ...) [2]

(e) Write down the range of $f(x)$.

..... [1]

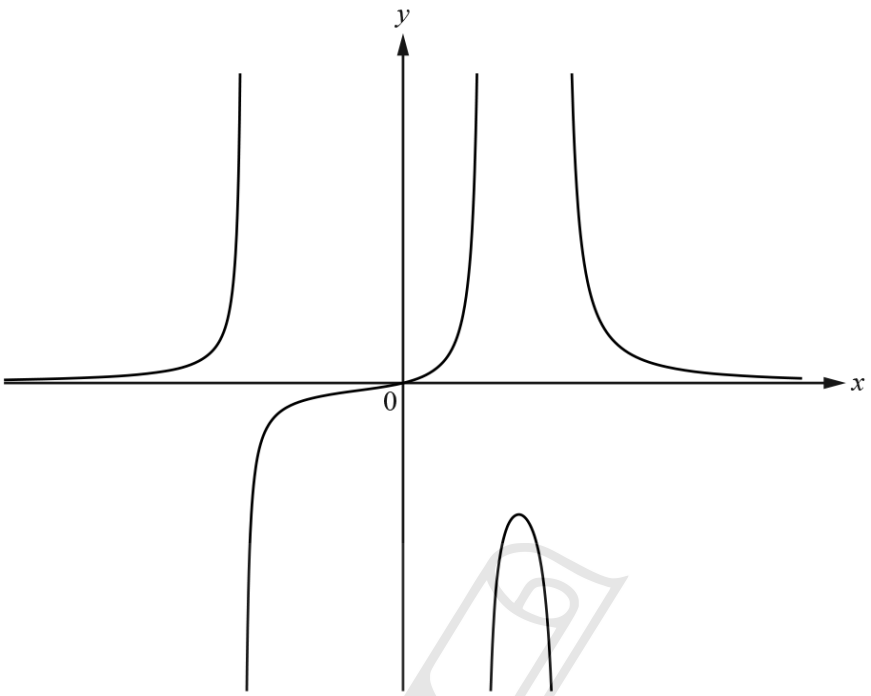
(f) By sketching another graph on the diagram, solve this equation.

$$\sin(x^2) = \frac{x^2}{20} - 1$$

$x =$ ..... [2]

57. 0607_s16_qp_42 Q: 8

The diagram shows the graph of $y = f(x)$ where $f(x) = \dfrac{x}{(x+2)(x-1)(x-2)}$.



(a) The equations of the asymptotes to the graph are $x = a$, $x = b$, $x = c$ and $y = d$.

Find the values of a, b, c and d.

$a =$ .....

$b =$ .....

$c =$ .....

$d =$ ..... [4]

(b) $f(x) = k$ has only one solution, where k is an integer and $k \neq 0$.

Find the value of k.

$k =$ ..... [1]

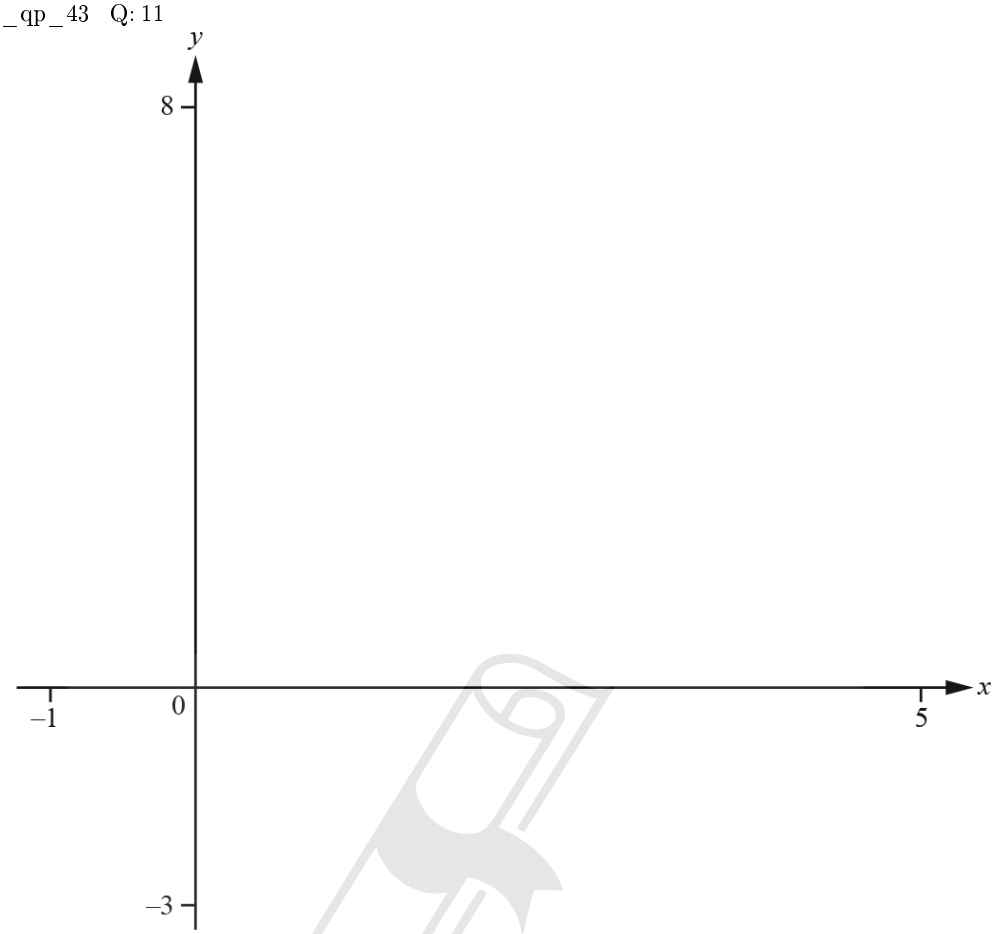
(c) Find the integer value of x such that $f(x) < 0$.

$x =$ ..... [1]

(d) $g(x) = x^2 - p$

On the diagram, sketch a possible graph of $y = g(x)$ so that $f(x) = g(x)$ has 5 solutions. [2]

58. 0607_s16_qp_43 Q: 11



$f(x) = 3 + \dfrac{1}{(x^2 - 4x + 3)}$

(a) On the diagram, sketch the graph of $y = f(x)$ between $x = -1$ and $x = 5$. [4]

(b) Write down the equations of the three asymptotes.

..... , ... , ... [3]

(c) Write down the co-ordinates of the local maximum point.

(..... , ...) [1]

(d) The line $y = x$ intersects the curve $y = 3 + \dfrac{1}{(x^2 - 4x + 3)}$ three times.

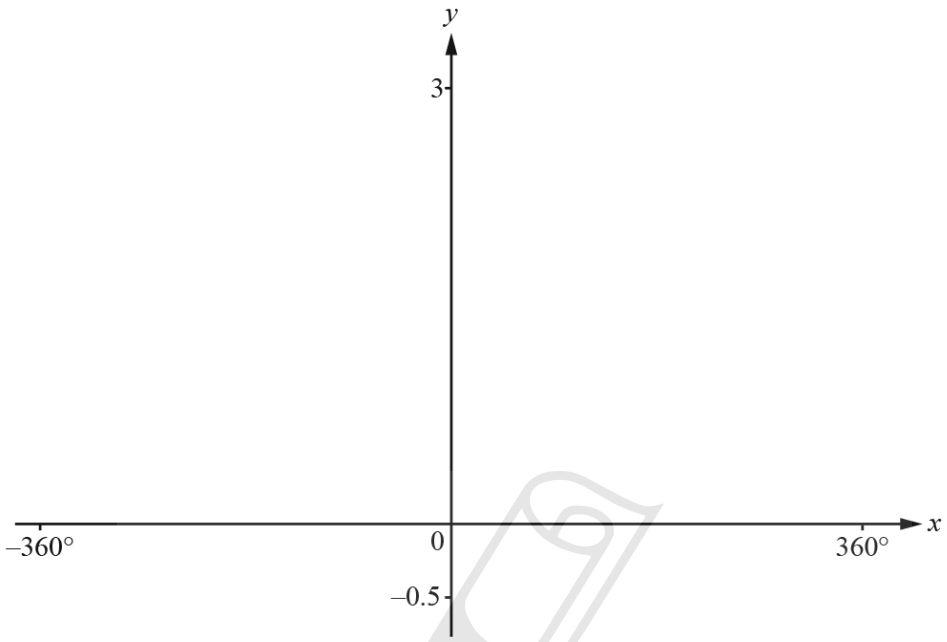
Find the values of the x co-ordinates of these three points of intersection.

$x =$ ..... , $x =$ ..... , $x =$ ..... [3]

59. 0607_w16_qp_41 Q: 3

$f(x) = 2^{\sin x}$

(a) On the diagram, sketch the graph of $y = f(x)$ for $-360° \leqslant x \leqslant 360°$.



[3]

(b) Find the range of $f(x)$.

..... [2]

(c) Find the value of $f(x)$ when

(i) $x = 3780°$,

..... [1]

(ii) $x = 4050°$.

..... [1]

(d) **(i)** Find the four values of x from $-360°$ to $1080°$ for which $f(x) = 0.5$.

..... , ... , ... , ... [2]

(ii) The values in the answer to **part (d)(i)** form the first four terms of a sequence.

Find the nth term of this sequence.

..... [2]

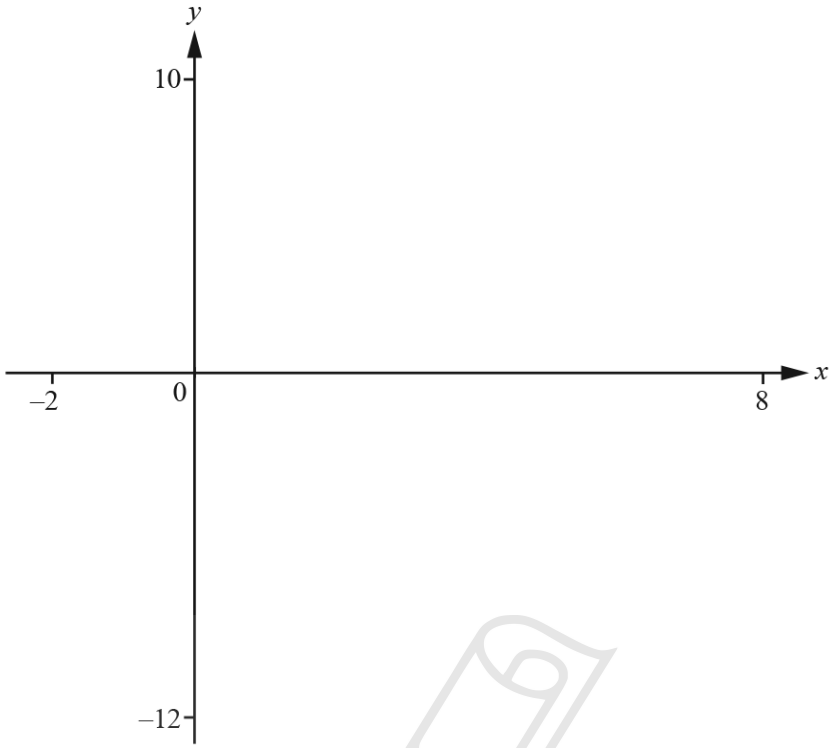
(e) $g(x) = \dfrac{x(360-x)}{16200}$

(i) On the diagram, sketch the graph of $y = g(x)$ for $0° \leqslant x \leqslant 360°$. [2]

(ii) Solve the equation $f(x) = g(x)$.

$x =$ ..... or $x =$ ..... [2]

60. 0607_w16_qp_42 Q: 14



$f(x) = 2^x - \frac{1}{3}x^3$

(a) On the diagram, sketch the graph of $y = f(x)$, for values of x between -2 and 8. [4]

(b) Write down the ***y* co-ordinates** of the local minimum points.

y = ... and y = ... [2]

(c) Write down the co-ordinates of the local maximum point.

(..... , ...) [2]

(d) Solve the equation $2^x - \frac{1}{3}x^3 = 2(1-x)$, for all real values of x.

x = ... or x = ... or x = ... or x = ... [4]

61. 0607_w16_qp_43 Q: 10

(a) **(i)** Factorise.

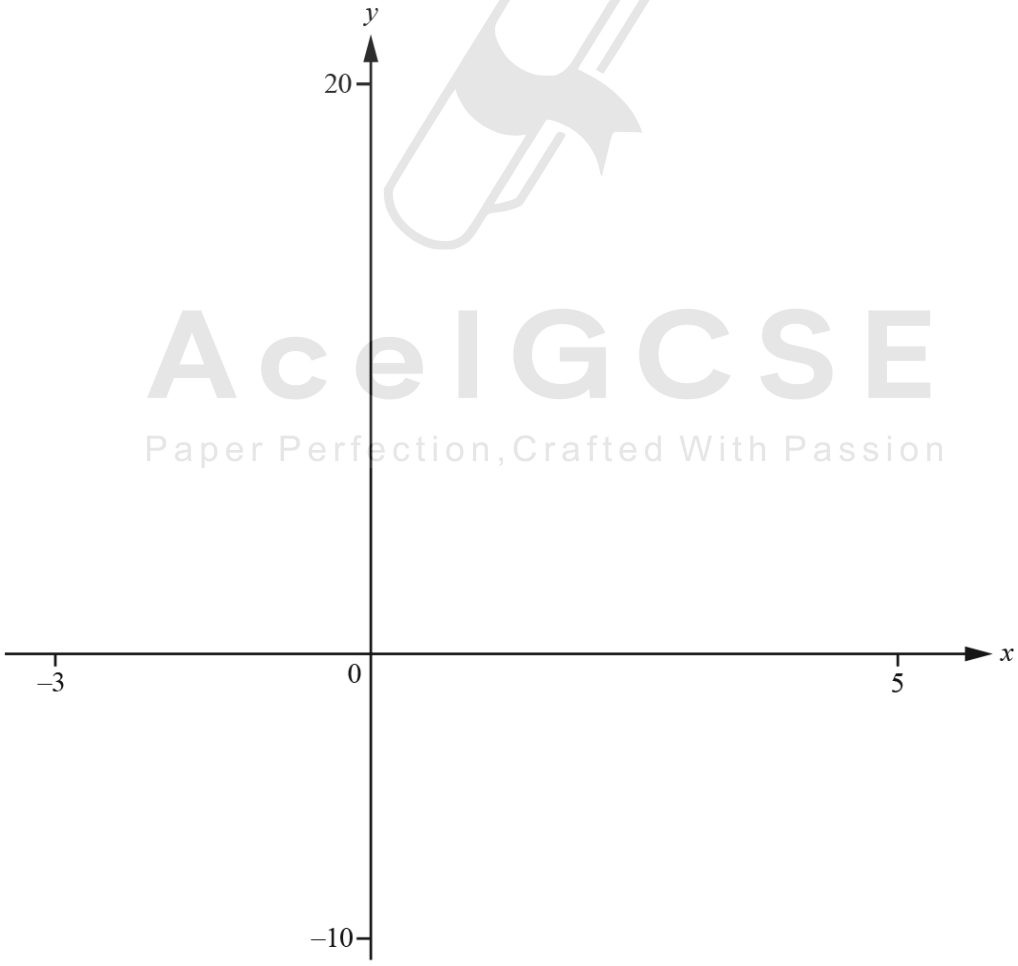
$$2x^2 - 3x + 1$$

..... [2]

(ii) Show that $2x + 1 + \frac{3}{x-2}$ can be written as $\frac{(2x-1)(x-1)}{(x-2)}$.

[3]

(b)



$$f(x) = \frac{(2x-1)(x-1)}{(x-2)}$$

(i) On the diagram, sketch the graph of $y = f(x)$ for values of x between -3 and 5. [2]

(ii) On the same diagram, sketch the graph of $y = 2x + 1$. [2]

(iii) Write down the equations of the asymptotes to the graph of $y = \mathrm{f}(x)$.

.....

..... [2]

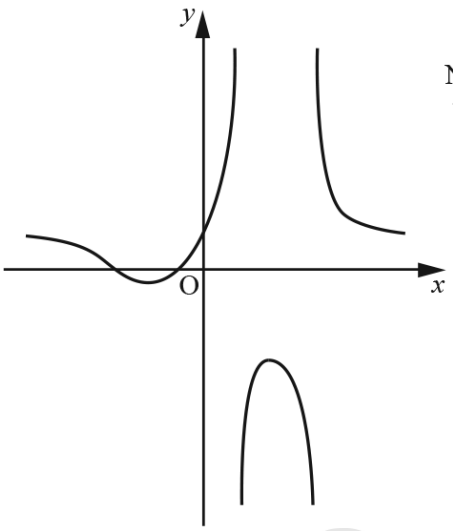
(iv) Solve $\mathrm{f}(x) = 0$.

$x =$ ..... or $x =$ ..... [2]

---

62. 0607_s15_qp_41 Q: 15

The diagram shows a sketch of the graph of $y = \mathrm{f}(x)$ where $\mathrm{f}(x) = \dfrac{x^2 + 4x + 3}{x^2 - 4x + 3}$.



NOT TO SCALE

(a) **(i)** Find the equations of the three asymptotes.

Answer(a)(i) ....., ..., ... [3]

(ii) Find the co-ordinates of the local maximum point.

Answer(a)(ii) (....., ...) [2]

(iii) Find the co-ordinates of the local minimum point.

Answer(a)(iii) (....., ...) [2]

(b) Find the values of k, when

(i) $\mathrm{f}(x) = k$ has no solutions,

Answer(b)(i) ..... [2]

(ii) $\mathrm{f}(x) = k$ has one solution.

Answer(b)(ii) ..... [1]

(c) Solve the inequality $\mathrm{f}(x) > 0$.

Answer(c) ..... [3]

63. 0607_s15_qp_42 Q: 10

$f(x) = 2\tan(x + 30)°$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between –90 and 360. [3]

(b) Solve the equation $f(x) = 5$ for values of x between –90 and 360.

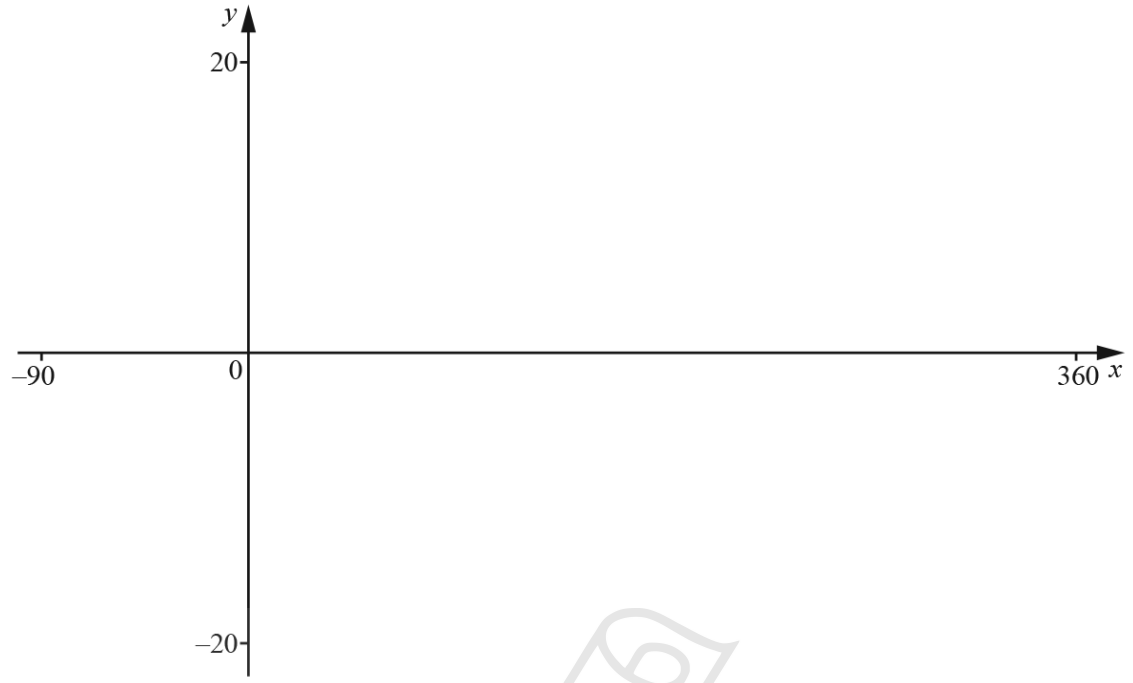
Answer(b) x = ... or x = ... [2]

(c) Write down the equations of the two asymptotes to this graph for values of x between –90 and 360.

Answer(c) .....

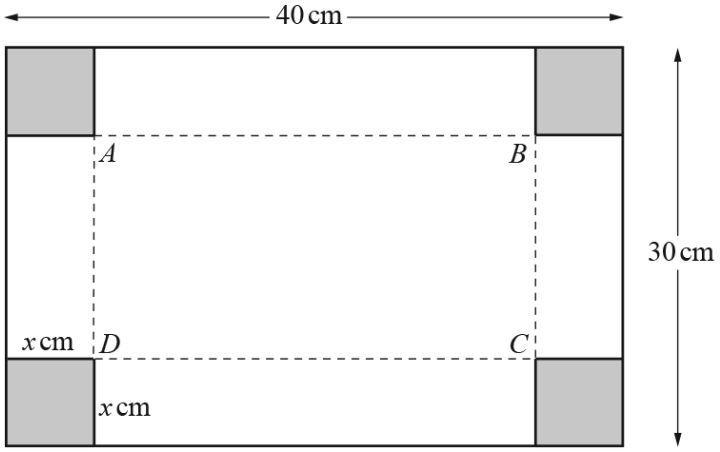
..... [2]

(d) On the diagram below, sketch the graph of $y = |2\tan(x + 30)°|$ for values of x between –90 and 360.



[2]

64. 0607_s15_qp_43 Q: 5



NOT TO SCALE

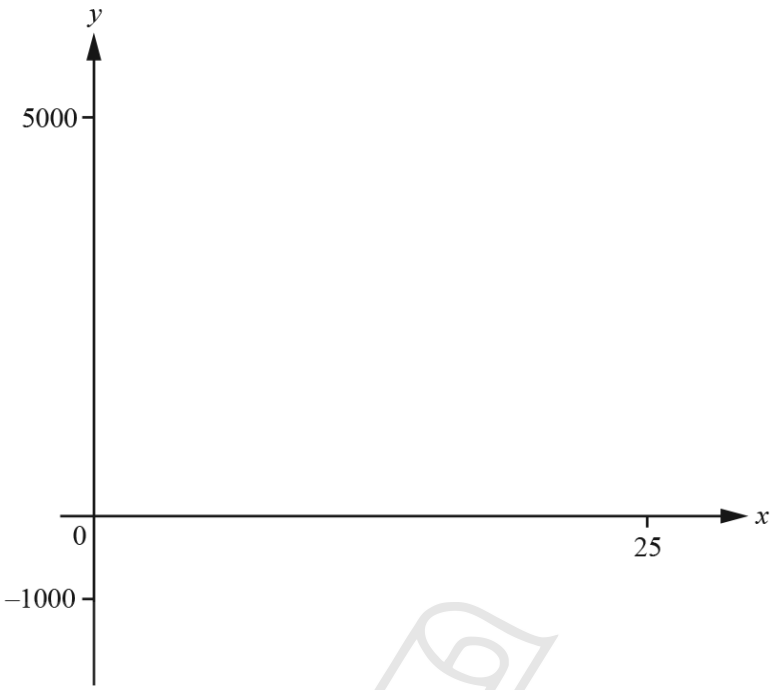
The diagram shows a rectangle, with sides 40 cm and 30 cm, made from a metal sheet.

A square of side x cm is cut from each of the four corners of the rectangle.
The remaining shape is folded up to make a rectangular open box with $ABCD$ as the base.
The height of the box is x cm.

(a) Show that the volume of the box is $1200x - 140x^2 + 4x^3$.

[3]

(b) On the diagram, sketch the graph of $y = 1200x - 140x^2 + 4x^3$ for $0 \leqslant x \leqslant 25$.



[2]

(c) Solve the equation $1200x - 140x^2 + 4x^3 = 2000$.

Answer(c) $x =$ ..... or $x =$ ..... or $x =$ ..... [3]

(d) Which solution to **part (c)** is not a possible value of x when the volume of the box is 2000 cm^3? Give a reason for your answer.

Answer(d) .....

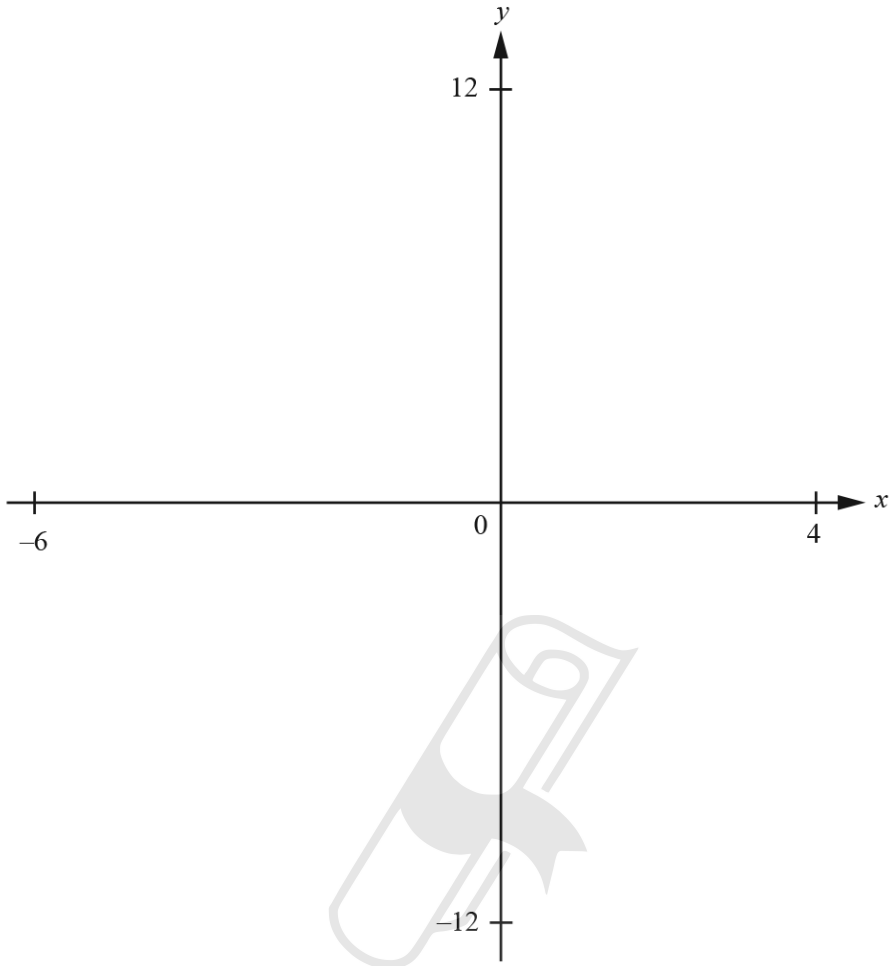
..... [1]

(e) What is the maximum volume of the box?
For this volume what is the length of the box?

Answer(e) Maximum volume = ... cm^3

Length = ... cm [2]

65. 0607_s15_qp_43 Q: 11



$$f(x) = \frac{(1-2x)}{(x+3)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between $x = -6$ and $x = 4$. [3]

(b) Write down the equations of the asymptotes of the graph of $y = f(x)$.

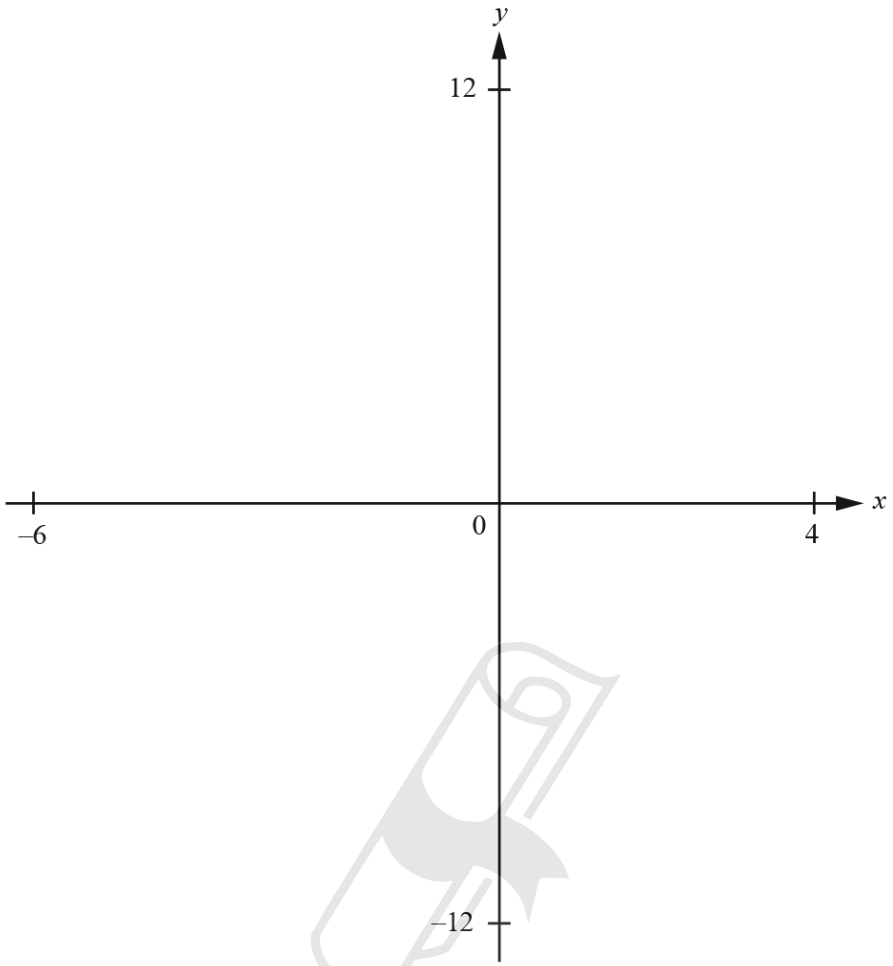
Answer(b) .....

..... [2]

(c) Find the range of values for y when $x \geqslant 0$.

Answer(c) ..... [2]

(d)

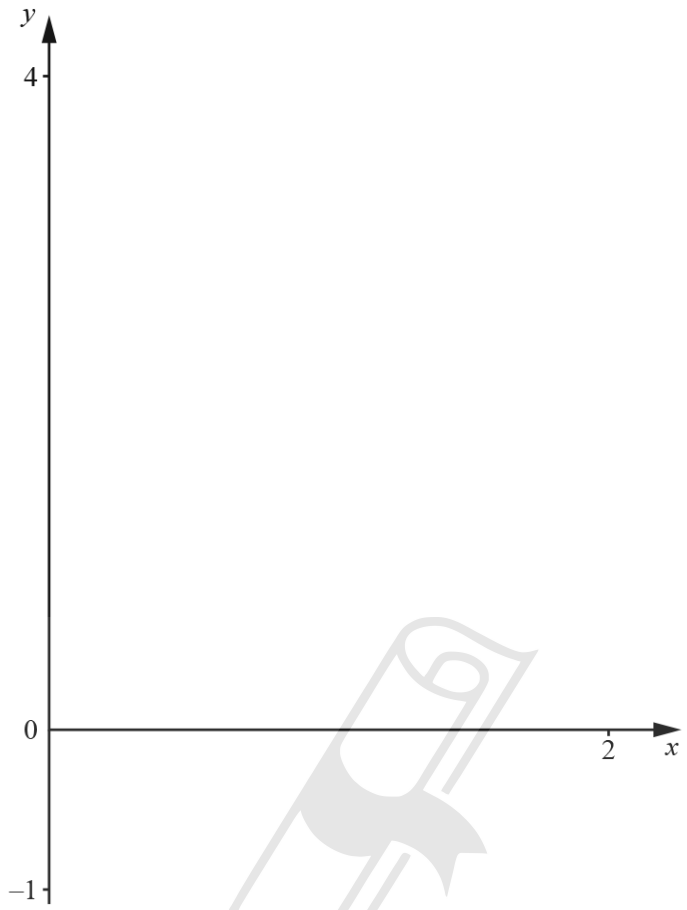


On this diagram, sketch the graph of $y = \left|\frac{(1-2x)}{(x+3)}\right|$. [2]

(e) Solve $\left|\frac{(1-2x)}{(x+3)}\right| = 6$.

Answer(e) $x =$ ..... or $x =$ ..... [2]

66. 0607_w15_qp_41 Q: 8



$f(x) = 3 - x^2$ $g(x) = x^x$

(a) On the diagram, sketch the graphs of $y = f(x)$ and $y = g(x)$ for values between $x = 0$ and $x = 2$. [4]

(b) Solve the equation $3 - x^2 = x^x$ for $0 \leqslant x \leqslant 2$.

Answer(b) $x =$ ..... [1]

(c) Solve the equation $3 - x^2 = 0$ for $0 \leqslant x \leqslant 2$.

Answer(c) $x =$ ..... [1]

(d) **(i)** Find the co-ordinates of the local minimum point on the graph of $y = g(x)$.

Answer(d)(i) (..... , ...) [2]

(ii) Find the range of $g(x)$ for the domain $0 < x \leqslant 2$.

Answer(d)(ii) ..... [2]

(e) **(i)** Find the values of the following.

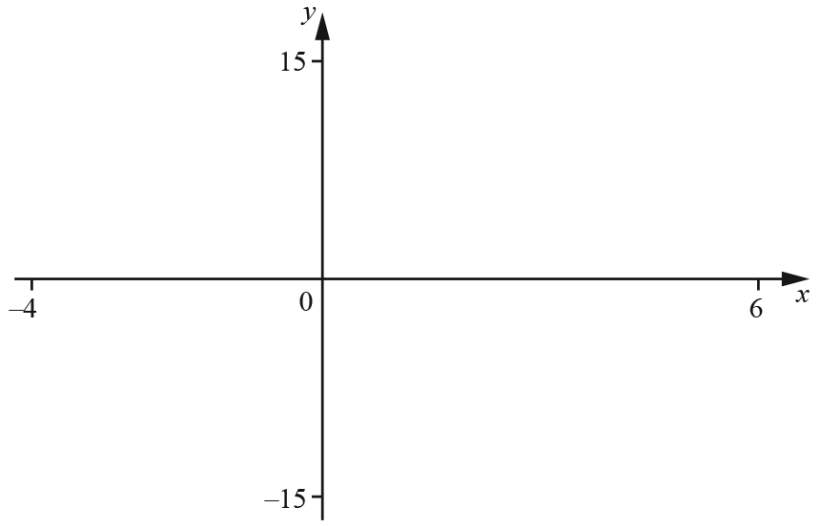
g(0.1) = ... g(0.01) = ... g(0.001) = ... [3]

(ii) Complete the statement.

Starting from $x = 0.1$, as x gets closer and closer to 0,

$g(x)$ gets closer and closer to the value ..... [1]

67. 0607_w15_qp_42 Q: 7



$$f(x) = \frac{(6x + 11)}{(2x - 3)}$$

(a) **(i)** On the diagram, sketch the graph of $y = f(x)$, for values of x between $x = -4$ and $x = 6$. [2]

(ii) Write down the equations of the asymptotes.

Answer(a)(ii) ....., ... [2]

(iii) Write down the co-ordinates of the points where the graph crosses the axes.

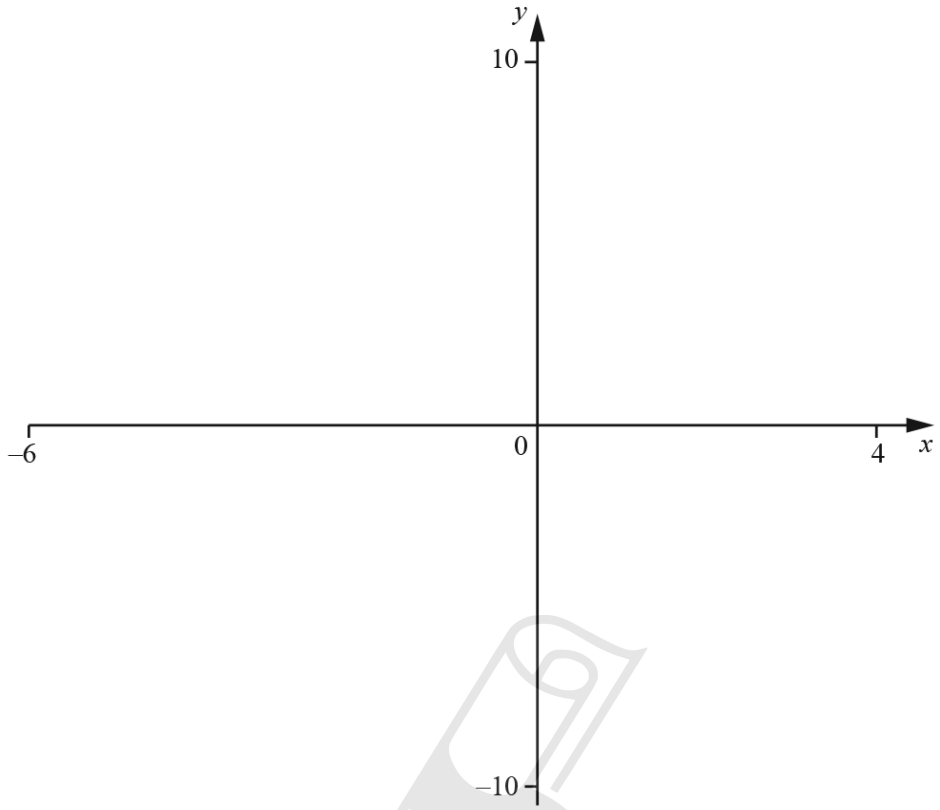
Answer(a)(iii) (....., ...), (....., ...) [2]

(b) Solve the inequality.

$$x < \frac{(6x + 11)}{(2x - 3)}$$

Answer(b) ..... [4]

68. 0607_w15_qp_43 Q: 12



(a) On the diagram, sketch the graphs of $y = \frac{12}{(x+2)}$ and $y = 2^x - 5$

for values of x between $x = -6$ and $x = 4$. [4]

(b) Write down the equation of each asymptote of the graph of

(i) $y = \frac{12}{x+2}$,

Answer(b)(i) .....

..... [2]

(ii) $y = 2^x - 5$.

Answer(b)(ii) ..... [1]

(c) Solve the inequality.

$2^x - 5 > \frac{12}{x+2}$ for $x > 0$.

Answer(c) ..... [2]

69. 0607_s20_qp_42 Q: 9

$f(x) = 4 - 3x$ $\quad g(x) = \frac{1}{x-1}, \ x \neq 1$ $\quad h(x) = x^2$

(a) Find

(i) $f(2)$,

..... [1]

(ii) $f(g(4))$.

..... [2]

(b) Find $g(g(-1))$.

..... [2]

(c) Solve.

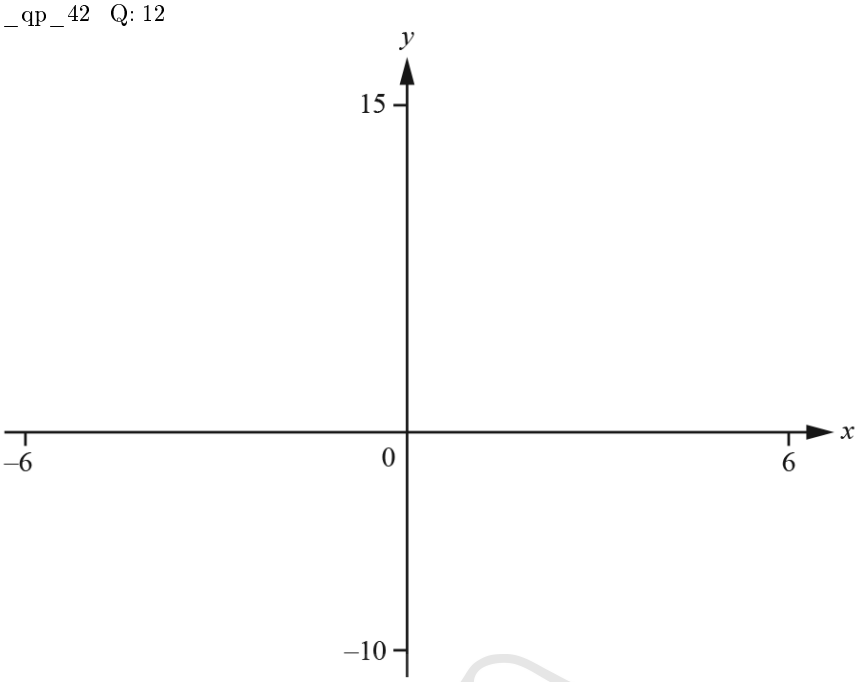
$h(f(x)) = 9$

$x =$ ..... or $x =$ ..... [3]

(d) Find $(f(x))^2 - 1$ in terms of x.
Give your answer in the form $k(ax+b)(cx+d)$ where a, b, c, d and k are integers.

..... [3]

70. 0607_w18_qp_42 Q: 12



$$f(x) = \frac{(2x-3)}{(x+2)}$$

(a) On the diagram, sketch the graph of $y = f(x)$ for values of x between -6 and 6. [3]

(b) Write down the equations of the asymptotes of $y = f(x)$.

.....

..... [2]

(c) $g(x) = 5 - 2x$

(i) Solve $f(x) = g(x)$.

$x =$ ..... or $x =$ ..... [2]

(ii) Find $g(f(x))$.
Give your answer as a single fraction in its simplest form.

..... [3]

71. 0607_w17_qp_43 Q: 1

$f(x) = 3x - 2$ $\quad g(x) = \frac{1}{x},\ x \neq 0$ $\quad h(x) = (x+2)^2$

(a) Find

(i) f(4),

..... [1]

(ii) gf(4).

..... [1]

(b) Find g(g(5)).

..... [2]

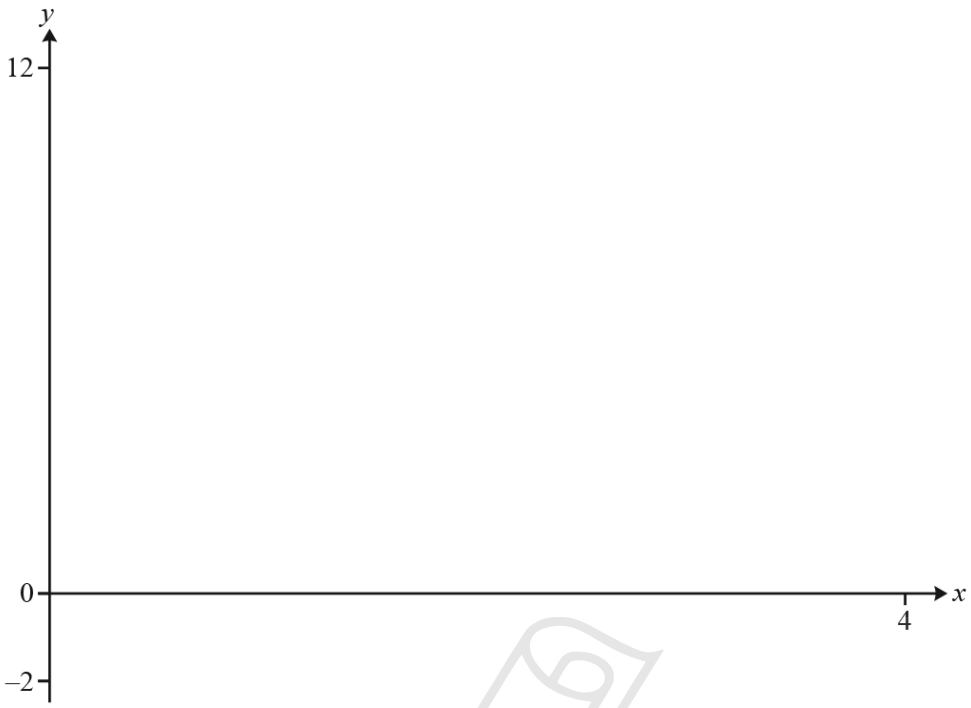
(c) Solve f(h(x)) = 10.

x = ... or x = ... [3]

(d) Find g(h(f(x))) in terms of x.

..... [2]

72. 0607_w17_qp_43 Q: 9



$f(x) = 10 + x - x^2$ for $0 \leqslant x \leqslant 4$

(a) (i) On the diagram, sketch the graph of $y = f(x)$. [2]

(ii) Write down the co-ordinates of the points where the graph crosses the axes.

(..... , ...) or (..... , ...) [2]

(iii) Solve $f(x) = 1$.

$x =$ ..... [1]

(b) $g(x) = x^2 - 10\log x$

(i) On the same diagram, sketch the graph of $y = g(x)$, for $0 < x \leqslant 4$. [2]

(ii) Write down the co-ordinates of the minimum point of $g(x)$.

(..... , ...) [2]

(iii) Solve the equation.

$$f(x) = g(x)$$

..... [2]

(iv) Solve the equation.

$$f(x - 1) = g(x - 1)$$

..... [2]

73. 0607_m21_qp_42 Q: 11

$f(x) = 3x + 1$ $g(x) = x^2 - 5$ $h(x) = 3^x$

(a) Find g(3).

..... [1]

(b) Find f(h(2)).

..... [2]

(c) Find the value of r when $f(r) = r$.

$r =$ ..... [2]

(d) Solve $g(f(x)) = 20$.

$x =$ ..... or $x =$ ..... [3]

(e) Find $h^{-1}(x)$.

$h^{-1}(x) =$ ..... [2]

74. 0607_s21_qp_41 Q: 5

$f(x) = 2x - 1$ $g(x) = 3 - x$ $h(x) = x^2$

(a) Find

(i) $f(-2)$,

..... [1]

(ii) $h(g(-2))$.

..... [2]

(b) Solve $f(x) = 7$.

$x =$ ..... [2]

(c) Find $f(g(x))$.

..... [1]

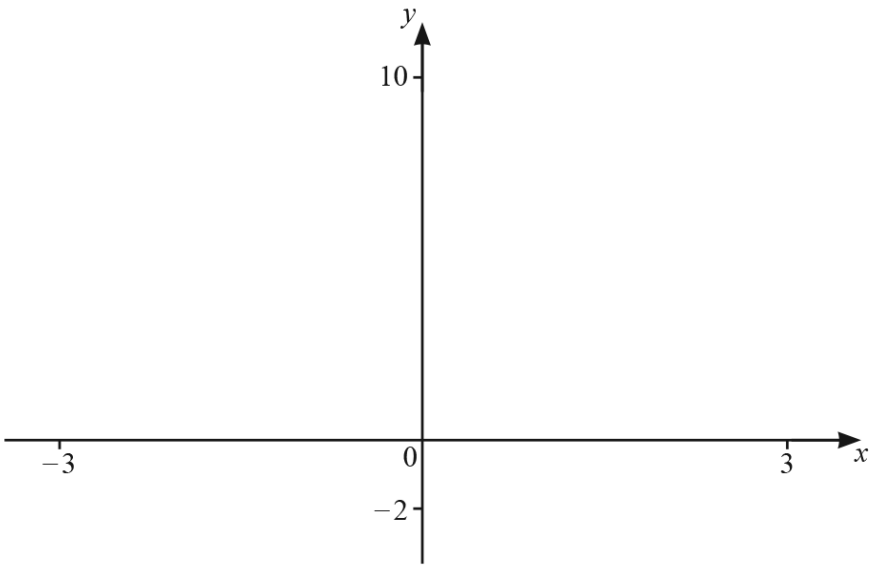
(d) Solve $f(x) \times g(x) + 2h(x) = 0$.

$x =$ ..... [3]

(e) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(f)



(i) On the diagram, sketch the graph of $y = \mathrm{h}(x)$ for values of x between -3 and 3. [2]

(ii) Write down the equation of the line of symmetry of the graph of $y = \mathrm{h}(x)$.

..... [1]

(iii) On the diagram, sketch the graph of $y = \mathrm{g}(x)$ for values of x between -3 and 3. [1]

(iv) Solve $\mathrm{g}(x) > \mathrm{h}(x)$.

..... [2]

75. 0607_s21_qp_42 Q: 12

$f(x) = 2 - 3x$ $\quad$ $g(x) = \dfrac{5}{2-3x}$

(a) Find f(4).

..... [1]

(b) Solve $g(x) = 4$.

..... [3]

(c) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(d) Find $g(f(x))$.
Write your answer as a single fraction in its simplest form.

..... [2]

(e) Find $f(x) - g(x)$.
Write your answer as a single fraction in its simplest form.

..... [3]

76. 0607_w21_qp_41 Q: 10

$f(x) = 3x - 2$ $g(x) = (x-3)^2$

(a) Find $f(g(1))$.

..... [2]

(b) Solve $g(x) = 25$.

$x =$ ..... or $x =$ ..... [2]

(c) Find $f^{-1}(4)$.

..... [2]

(d) Write down $f(f^{-1}(x))$.

..... [1]

77. 0607_s20_qp_43 Q: 12

$f(x) = 2x + 3$ $g(x) = 5 - 3x$

(a) Find $f(4)$.

..... [1]

(b) Solve $f(x) - g(x) = 5$.

$x =$ ..... [2]

(c) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(d) Find and simplify $f(g(x))$.

..... [2]

(e) Simplify $\frac{2}{f(x)} + \frac{3}{g(x)}$.

..... [3]

78. 0607_w20_qp_42 Q: 11

$f(x) = 5 - 3x$ $\quad\quad$ $g(x) = 2x + 7$

(a) Solve $f(x) = g(x)$.

..... [2]

(b) Find and simplify $g(f(x))$.

..... [2]

(c) **(i)** Find $f(x^2) + g(x^2)$ simplifying your answer.

..... [2]

(ii) Find $(f(x) + g(x))^2$ giving your answer in the form $ax^2 + bx + c$.

..... [3]

(d) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(e) Write as a single fraction in its simplest form.

$$\frac{2}{f(x)} - \frac{3}{g(x)}$$

..... [3]

79. 0607_w20_qp_43 Q: 11

$f(x) = x^3$ $g(x) = 3^x$

(a) Find $g(2) - f(2)$.

..... [2]

(b) Find x when $g(x) = \frac{1}{9}$.

..... [1]

(c) Write $x - \frac{1}{f(x)}$ in terms of x.

Give your answer as a single fraction.

..... [2]

(d) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [1]

80. 0607_s19_qp_41 Q: 10

(a) $f(x) = 5 - 2x$ $\quad\quad$ $g(x) = 3x + 2$

(i) Find $f(-3)$.

..... [1]

(ii) Find $f(g(4))$.

..... [2]

(iii) Solve $\dfrac{f(x)}{g(x)} = 2$.

$x =$ ..... [3]

(iv) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(v) Find and simplify $g(f(x))$.

..... [2]

(vi) Write as a single fraction in its simplest form.

$$\frac{3}{\mathrm{f}(x)} + \frac{2}{\mathrm{g}(x)}$$

..... [3]

(b) The function $\mathrm{h}(x)$ has an inverse function $\mathrm{j}(x)$.

Write down, in its simplest form, $\mathrm{j}(\mathrm{h}(x))$.

..... [1]

81. 0607_w19_qp_42 Q: 2

$$f(x) = \frac{1}{x-2},\ x \neq 2 \qquad g(x) = x+2 \qquad h(x) = x^2$$

(a) Find $f(6)$.

..... [1]

(b) Solve $f(x) = -2$.

$x =$ ..... [2]

(c) Find $h(g(x))$.

..... [1]

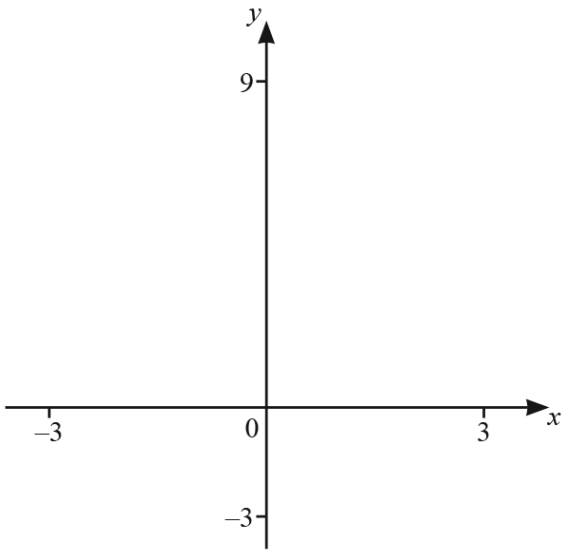
(d) Solve $h(g(x)) = h(x) + 2$.

$x =$ ..... [4]

(e) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [3]

(f)



(i) On the diagram, sketch the graph of $y = \mathrm{f}(x)$ and the graph of $y = \mathrm{h}(x)$ for values of x between -3 and 3. [3]

(ii) Write down the equation of the line of symmetry of $y = \mathrm{h}(x)$.

..... [1]

(iii) Solve $\mathrm{f}(x) > \mathrm{h}(x)$.

..... [2]

82. 0607_w19_qp_43 Q: 13

$f(x) = 2x + 5$ $g(x) = 1 - 2x$

(a) Find $g(-4)$.

..... [1]

(b) Find $f^{-1}(-7)$.

..... [2]

(c) Find $g(f(3))$.

..... [2]

(d) Find and simplify $f(g(x))$.

..... [2]

(e) Find and simplify $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(f) Write as a single fraction, simplifying your answer.

$$2 + \frac{3}{f(x)}$$

..... [2]

83. 0607_s18_qp_41 Q: 11

$f(x) = 10^x$ $g(x) = 2x - 1$

(a) Find the value of g(3).

..... [1]

(b) Find the range of $f(x)$ for the domain $\{-1, 0, 1, 2\}$.

{ ..... } [2]

(c) Find x when $g(x) = 12$.

$x =$ ..... [2]

(d) The graph of $y = g(x)$ is translated by the vector $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ onto the graph of $h(x)$.

Find $h(x)$.
Give your answer in its simplest form.

$h(x) =$ ..... [3]

(e) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(f) $\tan(g(x)) = 1$ and $0° \leqslant x \leqslant 180°$.

Find the two values of x.

$x =$ ..... or $x =$ ..... [3]

84. 0607_s18_qp_42 Q: 11

$f(x) = 2x - 7$ $g(x) = \sqrt{x}$ $h(x) = \frac{1}{x}$, $x \neq 0$

(a) **(i)** Find $f(3)$.

..... [1]

(ii) Solve $f(x) = 1$.

$x =$ ..... [2]

(b) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(c) **(i)** Find $f(g(x))$ in terms of x.

..... [1]

(ii) Solve $f(g(x)) = 5$.

$x =$ ..... [3]

(d) **(i)** Find $h(g(f(x)))$ in terms of x.

..... [2]

(ii) Find an inequality in terms of x for which $h(g(f(x)))$ exists.

..... [2]

85. 0607_s18_qp_43 Q: 12

$f(x) = 2x + 1$ $g(x) = 4 - 3x$ $h(x) = 2^x - 1$

(a) Find $h(-2)$.

..... [1]

(b) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(c) Find $g(f(3))$.

..... [2]

(d) Find and simplify $g(g(x))$.

..... [2]

(e) Find $h^{-1}(7)$.

..... [2]

(f) Write as a single fraction in its simplest form.

$$\frac{1}{f(x)} + \frac{1}{g(x)}$$

..... [3]

86. 0607_w18_qp_43 Q: 13

$f(x) = 1 - x$ $g(x) = 3x - 2$ $h(x) = |x^2 - 4|$ $k(x) = 3x^2 + 2$

(a) Find $h(0)$.

..... [1]

(b) Find, giving your answer in its simplest form.

(i) $g(f(x))$

..... [2]

(ii) $g(x) \times f(x) + k(x)$

..... [3]

(c) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [1]

(d) Find x when

(i) $g(x) = 2$,

$x =$ ..... [2]

(ii) $h(x) = 3$.

$x =$ ..... [3]

87. 0607_s17_qp_43 Q: 8

$f(x) = x^2 + 1$ $g(x) = 3 + 2x$ $h(x) = \frac{1}{x+1}, x \neq -1$

(a) Find $f(-3)$.

..... [1]

(b) Find the value of g(h(1)).

..... [2]

(c) Simplify $f(g(x)) + f(x)$.

..... [3]

(d) Find $h^{-1}(x)$.

$h^{-1}(x) =$ ..... [3]

(e) Solve.

(i) $g(x) = 1$

$x =$ ..... [2]

(ii) $g^{-1}(x) = 1$

$x =$ ..... [1]

88. 0607_w17_qp_41 Q: 12

$f(x) = 5 - 3x$ $g(x) = 2x + 3$

(a) Solve $f(x) = 11$.

$x =$ ..... [2]

(b) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(c) Solve $f(x) \times g(x) = 0$.

..... [2]

(d) Simplify.

(i) $g^{-1}(g(x))$

..... [1]

(ii) $f(f(x)) + g(x)$

..... [3]

(iii) $\frac{2}{f(x)} + \frac{4}{g(x)}$

..... [3]

89. 0607_s16_qp_41 Q: 13

(a) $f(x) = 5 - 2x$

(i) Solve $\frac{1}{f(x)} = 2$.

$x =$ ..... [2]

(ii) Find and simplify $f(f(x))$.

..... [2]

(iii) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(b) $g(x)$ is a function with an inverse function $g^{-1}(x)$.

Write down the value of $g(g^{-1}(3))$.

..... [1]

90. 0607_s16_qp_42 Q: 10

$f(x) = x^2 - x - 30$ $g(x) = x^2 - 36$ $h(x) = 2x + 7$

(a) Find h(f(7)).

..... [2]

(b) Find $h^{-1}(x)$.

$h^{-1}(x) =$ ..... [2]

(c) Find g(h(x)) in its simplest factorised form.

..... [3]

(d) Simplify $\frac{f(x)}{g(x)}$.

..... [4]

91. 0607_w16_qp_41 Q: 11

$f(x) = 3x + 1$ $g(x) = \log x$

(a) Find the value of g(f(33)).

..... [2]

(b) Find the value of x when $g(x) = f(-1)$.

$x =$ ..... [2]

(c) Find

(i) $f^{-1}(x)$,

$f^{-1}(x) =$ ..... [2]

(ii) $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

92. 0607_s15_qp_42 Q: 12

$f(x) = 5x - 2$ $\quad g(x) = \frac{6}{4x+1},\ x \neq -\frac{1}{4}$ $\quad h(x) = 5x^2 + 3x - 2$

(a) Find $fg(1)$.

Answer(a) ..... [2]

(b) Find and simplify these expressions.

(i) $gf(x)$

Answer(b)(i) ..... [2]

(ii) $f^{-1}(x)$

Answer(b)(ii) ..... [2]

(c) Simplify.

(i) $\frac{f(x)}{h(x)}$

Answer(c)(i) ..... [3]

(ii) $g(x) - \frac{1}{f(x)}$

Answer(c)(ii) ..... [3]

93. 0607_s15_qp_43 Q: 12

$f(x) = 3x - 1 \qquad g(x) = 4 - 2x$

(a) Find

(i) $g(3)$,

Answer(a)(i) ..... [1]

(ii) $f(g(3))$.

Answer(a)(ii) ..... [1]

(b) Find and simplify expressions for

(i) $g(f(x))$,

Answer(b)(i) ..... [2]

(ii) $g^{-1}(x)$,

Answer(b)(ii) ..... [2]

(iii) $\frac{2}{f(x)} - \frac{3}{g(x)}$.

Answer(b)(iii) ..... [3]

94. 0607_m22_qp_42 Q: 8

$f(x) = 2x+1$ $g(x) = 3-2x$ $h(x) = \log(x+1)$

(a) Find the value of

(i) f(12),

..... [1]

(ii) g(f(12)).

..... [1]

(b) Find the value of x when $f(x) = g(x)$.

$x =$ ..... [2]

(c) Find f(g(x)), giving your answer in its simplest form.

..... [2]

(d) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

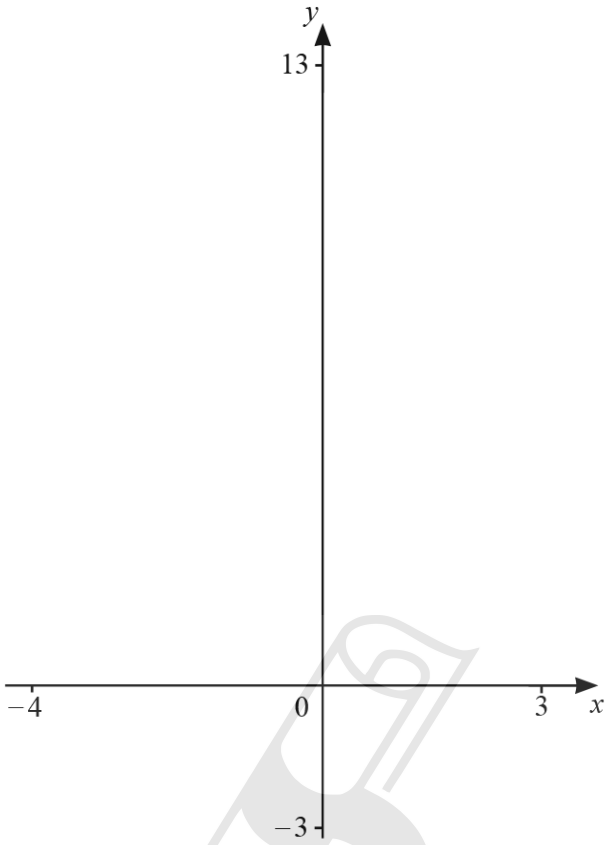
(e) Find x when $\mathrm{h}(x) = \mathrm{f}(0.5)$.

$x =$ ..... [2]

(f) Find $\mathrm{h}^{-1}(x)$.

$\mathrm{h}^{-1}(x) =$ ..... [2]

95. 0607_m21_qp_42 Q: 7



$g(x) = \frac{1}{x-2}$, $x \neq 2$

(a) On the diagram, sketch the graph of $y = g(x)$ for values of x between -4 and 3. [3]

(b) Write down the equations of the asymptotes of the graph of $y = g(x)$.

.....

..... [2]

(c) $h(x) = (x+1)^2 - 3$

Solve the inequality $g(x) > h(x)$.

..... [4]

96. 0607_s21_qp_41 Q: 7

(a) Solve the simultaneous equations.
You must show all your working.

$$7x+2y=8$$
$$2x-3y=13$$

$x =$ .....

$y =$ ..... [4]

(b) Solve.

(i) $3x-4=-19$

$x =$ ..... [2]

(ii) $15-5x=7-3x$

$x =$ ..... [2]

(iii) $\frac{28}{(x+1)}=-4$

$x =$ ..... [2]

(c) $3\log p-\log q-\log 8=2\log x$

Find x in terms of p and q.

$x =$ ..... [3]

97. 0607_s21_qp_43 Q: 11

(a) $f(x) = 3x + 2$ $g(x) = x^2$ $h(x) = 2^x$

(i) Find f(2).

..... [1]

(ii) Find f(g(3)).

..... [2]

(iii) Find the value of $\frac{h(g(3))}{g(h(3))}$.

..... [3]

(iv) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(v) Find $h^{-1}(x)$.

$h^{-1}(x) =$ ..... [2]

(b) **(i)** Find the value of $\log_3 81 - \log_9\left(\frac{1}{3}\right)$.

..... [2]

(ii) $\log_b 25 = \frac{2}{3}$

Find the value of b.

$b =$ ..... [2]

98. 0607_w21_qp_42 Q: 3

(a) The number of members in a social media group increases exponentially at a rate of 5% per month. At the start of the first month there are 882 members.

(i) Calculate the number of members at the end of 10 months.
Give your answer correct to the nearest integer.

..... [3]

(ii) Calculate the number of complete months from the start until the group has 2000 members.

..... [4]

(b) The mass of a radioactive substance decreases exponentially at a rate of r% per month. At the end of 10 months, its mass has decreased from 500 g to 242 g.

Find the value of r.

$r =$ ..... [3]

99. 0607_w21_qp_42 Q: 8

(a) $f(x) = 3x - 2$ $g(x) = 5x - 1$ $h(x) = \frac{1}{x+1}, x \neq -1$

(i) Find

(a) f(3),

..... [1]

(b) h(f(3)).

..... [1]

(ii) Find f(g(x)) in its simplest form.

..... [2]

(iii) Solve $f(x) = g(x)$.

$x =$ ..... [2]

(iv) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

(v) Simplify $2\mathrm{h}(x)+\mathrm{h}(x+1)$.

Give your answer as a single fraction, in terms of x, in its simplest form.

..... [4]

(b) $\mathrm{j}(x)=5^x$

(i) Find the value of x when $\mathrm{j}(x)=\frac{1}{5\sqrt{5}}$.

$x=$ ..... [1]

(ii) Find $\mathrm{j}^{-1}(x)$.

$\mathrm{j}^{-1}(x)=$ ..... [2]

100. 0607_s20_qp_41 Q: 6

(a)

(i) On the diagram, sketch the graph of $y = |\log x|$ for $0 < x \leqslant 5$. [2]

(ii) Solve the equations.

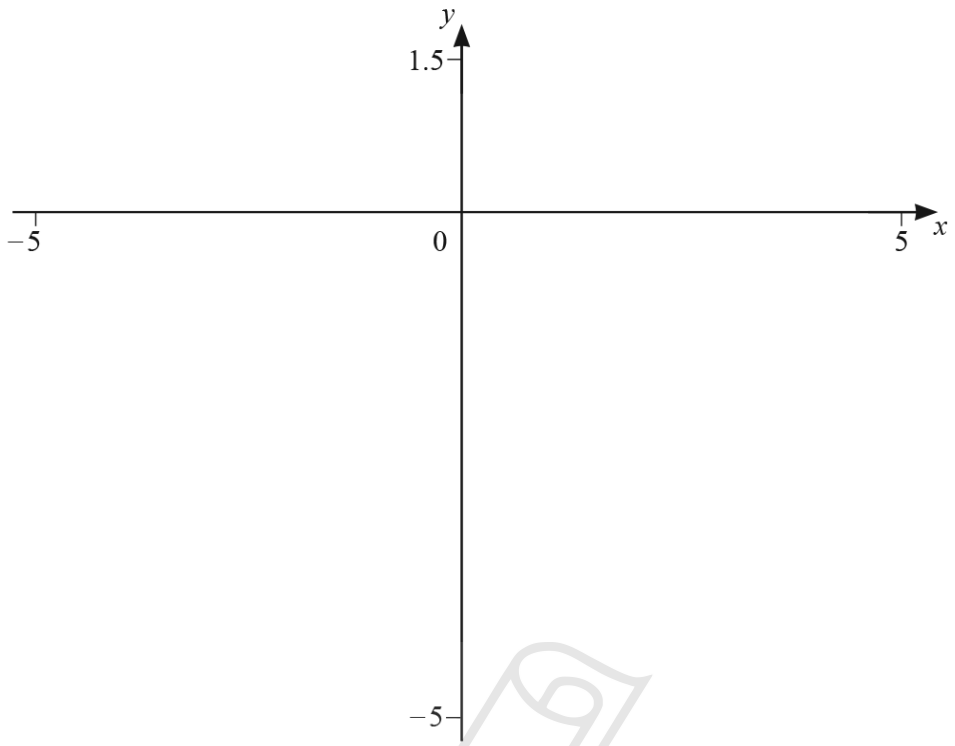
(a) $|\log x| = 0.2$

$x =$ ..... or $x =$ ..... [2]

(b) $|\log x| = 1 - \frac{x}{4}$

$x =$ ..... or $x =$ ..... [4]

(b)



(i) On the diagram, sketch the graph of $y = \log|x|$ for values of x between -5 and 5. [2]

(ii) Solve the equation $\log|x| = 0.2$.

$x =$ ..... or $x =$ ..... [2]

(c) Write down the range of values of x for which the graph of $y = |\log x|$ is the same as the graph of $y = \log|x|$.

..... [1]

101. 0607_s20_qp_41 Q: 10

$f(x) = 2x + 3$ $g(x) = 5^x$

(a) Find $f(g(3))$.

..... [2]

(b) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(c) Find x when $g(x) = \frac{1}{25\sqrt{5}}$.

$x =$ ..... [2]

(d) Find $g^{-1}(x)$.

$g^{-1}(x) =$ ..... [2]

---

102. 0607_s20_qp_42 Q: 11

(a) Solve the equations.

(i) $5+2x=1$

$x =$ ..... [2]

(ii) $6-\frac{10}{x}=1$

$x =$ ..... [2]

(iii) $3(1-2x)=2-4(x-7)$

$x =$ ..... [3]

(b) **(i)** Solve $6x^2=7-3x$.

Give your answers correct to 3 decimal places.
You must show all your working.

$x =$ ..... or $x =$ ..... [4]

(ii) Solve $6y^4 = 7 - 3y^2$.

Give your answers correct to 3 decimal places.

$y =$ ..... or $y =$ ..... [2]

(c) Solve $2\log x + \log 5 = 1$.

$x =$ ..... [4]

103. 0607_w20_qp_41 Q: 12

Solve the equations.

(a) $6-\frac{2}{x}=-2$

$x =$ ..... [3]

(b) $3+2(4x+5)=1-2(x+8)$

$x =$ ..... [3]

(c) $3\log x+2\log 3=2\log 6+\log 2$

$x =$ ..... [3]

(d) $2^x=10$

$x =$ ..... [3]

104. 0607_s19_qp_42 Q: 12

$f(x) = 10 - x$ $\quad g(x) = x^2 + 1$ $\quad h(x) = \frac{1}{x}$ $\quad j(x) = \log_3 x$

(a) Find g(3).

..... [1]

(b) Find f(h(2)).

..... [2]

(c) Find g(f(x)) in the form $ax^2 + bx + c$.

..... [3]

(d) For some functions, $p^{-1}(x) = p(x)$.

Write down which two functions, f(x), g(x), h(x) or j(x), have this property.

..... and ..... [2]

(e) Write $h(x) - \frac{1}{f(x)}$ as a single fraction in its simplest form.

..... [3]

(f) **(i)** Find $j(243)$.

..... [1]

(ii) Find x when $j(x) = 1.5$.

$x =$ ..... [1]

(iii) Find $j^{-1}(x)$.

$j^{-1}(x) =$ ..... [2]

---

105. 0607_s19_qp_43 Q: 9

(a) Solve the following equations.

(i) $\frac{135}{x} = 5$

$x =$ ..... [1]

(ii) $3x + 5 = 7x + 25$

$x =$ ..... [2]

(iii) $8x^2 = 11 - 2x$

$x =$ ..... or $x =$ ..... [4]

(b) Solve the following inequalities.

(i) $6 - 2x \geqslant 10$

..... [2]

(ii) $\frac{1}{x-2} > 3$

..... [3]

(c) Solve the simultaneous equations.
You must show all your working.

$$3x + 5y = -3$$
$$5x - 2y = 26$$

$x =$ .....

$y =$ ..... [4]

(d) Solve the equation.

$$\log x + 4\log 2 = \log 13$$

$x =$ ..... [3]

106. 0607_w19_qp_41 Q: 10

$f(x) = 2x + 3$ $\quad g(x) = \frac{1}{x},\ x \neq 0$ $\quad h(x) = 2^x$ $\quad j(x) = \log_3 x$

(a) Find

(i) $f(-2)$,

..... [1]

(ii) $g\left(\frac{1}{2}\right)$.

..... [1]

(b) Find $g(f(1))$.

..... [2]

(c) Find x when $h(x) = \frac{1}{8}$.

$x =$ ..... [1]

(d) Find $j(81)$.

..... [1]

(e) Find $f(f(x))$ in its simplest form.

..... [2]

(f) Find $f(x) \times f(x) + f(x) + 1$ in its simplest form.

..... [3]

(g) Find $j^{-1}(x)$.

$j^{-1}(x) =$ ..... [2]

107. 0607_w19_qp_43 Q: 11

(a) Simplify.

(i) $\dfrac{a^5 \times a^4}{a^3}$

..... [2]

(ii) $\log_5(5^x)$

..... [1]

(iii) $\log_9(3^x)$

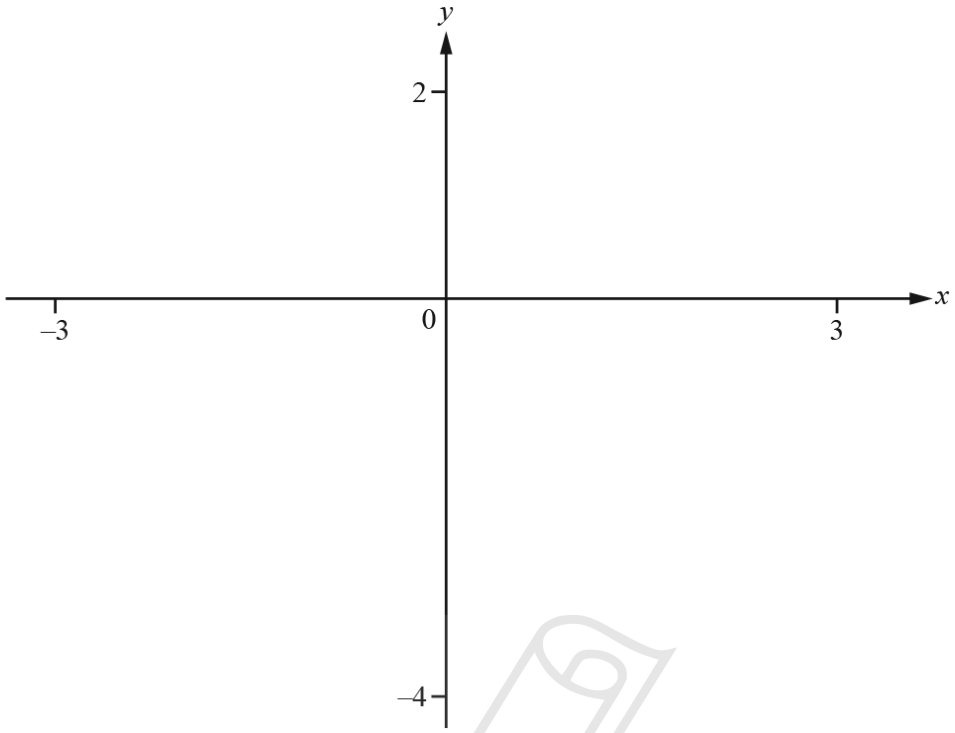
..... [1]

(b) Solve.

$3\log 10 - 2\log 5 = \log x$

$x =$ ..... [2]

108. 0607_s16_qp_41 Q: 8



$f(x) = \log(1 + 2x + x^2)$

(i) On the diagram, sketch the graph of $y = f(x)$ for values of x between –3 and 3. [2]

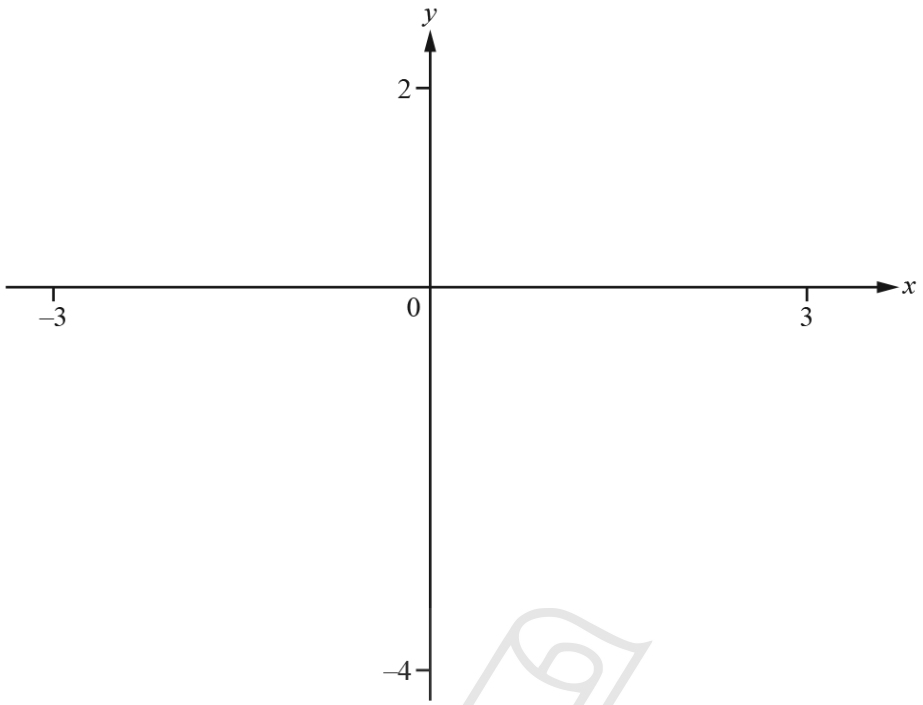
(ii) Solve $f(x) = 0$.

$x =$ ..... or $x =$ ..... [2]

(iii) Write down the equation of the asymptote to the graph of $y = f(x)$.

..... [1]

(b) **(i)** On this diagram, sketch the graph of $y = 2\log(1+x)$ for values of x between –3 and 3.



[2]

(ii) Describe a similarity between the graphs in **part (a)(i)** and **part (b)(i)**.

.....

..... [1]

(iii) Explain the differences between the graphs in **part (a)(i)** and **part (b)(i)**.

.....

..... [2]

109. 0607_w16_qp_42 Q: 13

(a) $3\log p + 2\log q - \log 6 = \log x$

Find x in terms of p and q.

x = ... [3]

(b) Solve the equations.

(i) $4^x = 6$

x = ... [3]

(ii) $(3x+2)(2x-3) = 1$

You must show all your working.

x = ... or x = ... [5]

110. 0607_w15_qp_41 Q : 10

$f(x) = 2x + 3$ $g(x) = x - 1$ $h(x) = \log (x + 1)$

(a) Find f(h(9)).

Answer(a) ..... [2]

(b) Find g(f(x)) in its simplest form.

Answer(b) ..... [2]

(c) Find $\frac{1}{f(x)} + \frac{1}{g(x)}$ in terms of x.

Give your answer as a single fraction.

Answer(c) ..... [3]

(d) Solve the equation.

$$h(x) = -1$$

Answer(d) $x =$ ..... [2]

(e) Solve the equation.

$$(g(x))^2 = 5$$

Give exact answers.

Answer(e) x ..... or $x =$ ..... [3]

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111. 0607_w15_qp_42 Q: 2

(a) Solve the equations.

(i) $4\log 3 - 3\log 4 = \log x - 5\log 2$

Answer(*a*)(i) $x =$ ..... [3]

(ii) $4\sin x + 3 = 1$ for $0° \leqslant x \leqslant 360°$

Answer(*a*)(ii) ..... [3]

(b) Make x the subject of the formula.

$$a = \sqrt{\frac{x-1}{x}}$$

Answer(*b*) $x =$ ..... [3]

112. 0607_w15_qp_42 Q: 15

Solve the inequalities.

(a) $\frac{5}{2x-1} < 3$

Answer(a) ..... [3]

(b) $\log(2^x) > 10$

Answer(b) ..... [2]

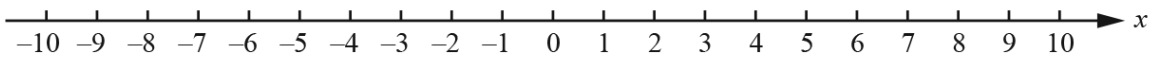
113. 0607_w15_qp_43 Q: 8

(a) **(i)** Solve the inequality.

$$2(x-3) < 5(x+3)$$

Answer(a)(i) ..... [3]

(ii) Show your answer to **part(a)(i)** on the number line.



[1]

(b) Solve the equation.

$$(x+3)^2 + (x+1)^2 = 25$$

Give your answers correct to 2 decimal places.

Answer(b) $x =$ ..... or $x =$ ..... [6]

(c) Solve the equations.

(i) $\log x = 5 - x$

Answer(c)(i) $x =$ ..... [3]

(ii) $\log x = |5 - x|$

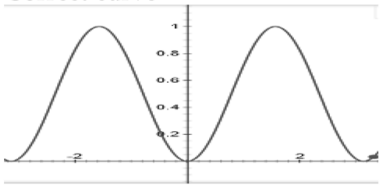
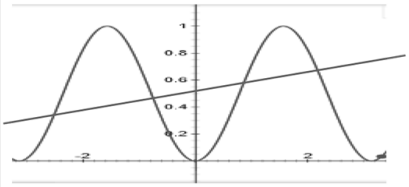
Answer(c)(ii) $x =$ ..... or $x =$ ..... [2]

(d) Simplify, giving your answer as a single fraction.

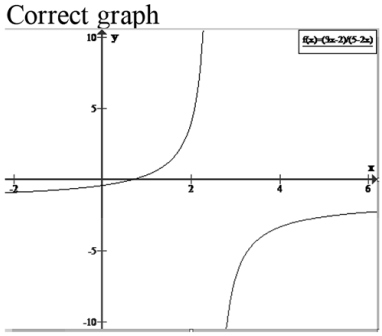
$$\frac{x}{x-1} - \frac{2}{x+1}$$

Answer(d) ..... [3]

01. 0607_m24_ms_42 Q: 1

Question	Answer	Marks	Partial Marks
(a)	Correct curve 	2	**B1** if cusp at (0, 0) or 'correct curve' but height clearly incorrect.
(b)	0.5 180	2	**B1** for each
(c)(i)	Correct sketch 	2	maximum of 1 mark if it does not intersect curve 4 times **B1** for positive gradient and positive y-intercept
(c)(ii)	–154 or –154.0... –40.4 or –40.36 to –40.35 50.9 or 50.87... 121 or 120.5 to 120.6	4	**B1** for each Max 3 if y coordinates included.
(c)(iii)	$-154 < x < -40.4$ $50.9 < x < 121$	2	**FT** from (c)(ii) **B1** for each Same accuracy as (ii)

02. 0607_m24_ms_42 Q: 10

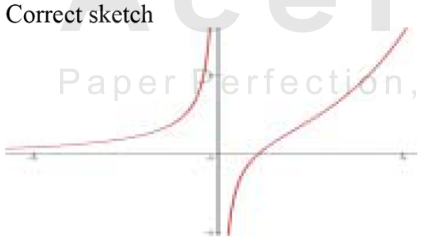
Question	Answer	Marks	Partial Marks
(a)(i)	9	**1**	
(a)(ii)	$4x^2 - 20x + 25$ final answer	**3**	**M1** for $(5 - 2x)^2$ **B1** for 3 terms correct in $25 - 10x - 10x + 4x^2$
(a)(iii)	$\frac{5-x}{2}$ oe final answer	**2**	**M1** for $x = 5 - 2y$ or $\frac{y}{2} = \frac{5}{2} - x$ or $y - 5 = -2x$
(b)(i)	Correct graph 	**3**	**B2** for correct but some 'curl back' or overlap or too wide a gap. **B1** for one branch correct.
(b)(ii)	$x = 2.5$ oe	**1**	
(b)(iii)	1.67 or 1.670 to 1.671 3.31 or 3.307 to 3.308	**3**	**B2** for one solution Max 1 if y coordinates included. or **M1** for sketch of $y = 5 - 2^x$ If 0 scored, **SC1** for only y values seen in answer space, with correct x values seen in working.

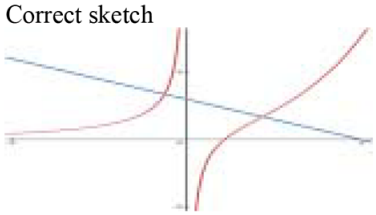
03. 0607_s24_ms_41 Q: 11

Question	Answer	Marks	Partial Marks
(a)	11	**1**	
(b)	–2	**2**	**M1** for $3x = -7 + 1$
(c)	$\frac{5-x}{2}$ oe final answer	**2**	**M1** for $x = 5 - 2y$ or $\frac{y}{2} = \frac{5}{2} - x$ or $2x = 5 - y$

Question	Answer	Marks	Partial Marks
(d)	$[h(f(x))] = \frac{1}{2(3x-1)-3}$	**M1**	
	$(5-2x)(6x-5)=7$	**A1**	All further FTs dep on second stage in correct form $(5-2x)(ax+b)=k$ where a, and b are integers or sketch of rectangular hyperbola
	Correct expansion of brackets	**M1**	$30x-25-12x^2+10x$ [= 7] or sketch of straight line with negative gradient
	Correct rearrangement to 3 term quadratic on one side	**M1**	$12x^2-40x+32=0$ oe or graphs intersecting twice in 1st quadrant
	Correct factorisation	**M1**	$(6x-8)(2x-4)=0$ oe or correct use of formula or correct sketch of the quadratic or solutions indicated at points of intersection
	$2, \frac{4}{3}$ oe	**B1**	Both answers correct

04. 0607_s24_ms_42 Q: 3

Question	Answer	Marks	Partial Marks
(a)(i)	2.1 oe	**1**	
(a)(ii)	2.5 oe	**1**	
(a)(iii)	10	**1**	
(a)(iv)	4.47 to 4.48	**2**	**B1** for 7.24 or 7.236... or for 2.76 or 2.763 to 2.764 or $5+\sqrt{5}$ or $5-\sqrt{5}$ seen
(b)(i)	Correct sketch 	**3**	**B2** for both branches correct but joined or with excessive feathering or curl-backs or **B1** for one correct branch

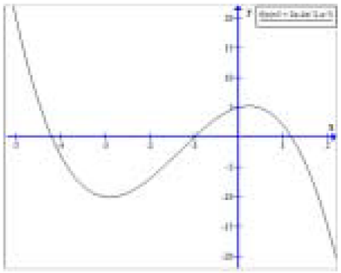
Question	Answer	Marks	Partial Marks
(b)(ii)	$x = 0$ $y = 0$	**2**	**B1** for each
(b)(iii)	$k > 0$ cao	**1**	
(b)(iv)(a)	Correct sketch 	**2**	**B1** for negative gradient and positive y-intercept or **B1** for passing through (3, 0)
(b)(iv)(b)	–0.382 or –0.3824 to –0.3823 1.3[0] or 1.302...	**2**	**B1** for each or **B1** for both correct values used in an inequality in x only

05. 0607_s24_ms_42 Q: 9

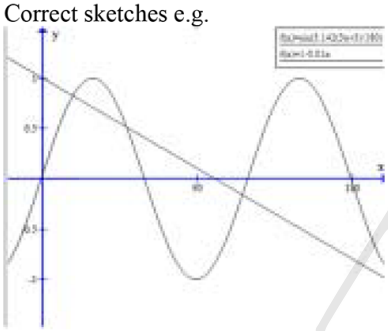
Question	Answer	Marks	Partial Marks
(a)(i)	–7	**1**	
(a)(ii)	4.084×10^6 cao	**3**	**B2** for 4 084 101 or $4.084\,101 \times 10^6$ or $4.0841[0] \times 10^6$ or answer 4.08×10^6 or **M1** for $(3 + 2 \times 9)^5$ If 0 scored, **SC1** for *their* 5 or more figure answer in standard form and corrected to 4 sf. or for 4 084 000 seen
(a)(iii)	$4x^2 + 12x + 10$ final answer	**3**	**M1** for $(3 + 2x)^2 + 1$ **B1** for $[(3 + 2x)^2 =]\ 9 + 6x + 6x + 4x^2$

Question	Answer	Marks	Partial Marks
(a)(iv)	$\frac{x-3}{2}$ oe final answer	**2**	**M1** for $x = 3 + 2y$ or $y - 3 = 2x$ or $\frac{y}{2} = \frac{3}{2} - x$
(a)(v)	$-1 \leqslant h(x) \leqslant 32$	**2**	**B1** for $-1 \leqslant h(x) \leqslant k$ or $k \leqslant h(x) \leqslant 32$ or –1 and 32 evaluated
(b)(i)	500	**2**	**M1** for $2x = 10^3$
(b)(ii)	$\frac{10^x}{2}$ oe final answer	**2**	**M1** for $2x = 10^y$ or $x = \log(2y)$
(b)(iii)	$4x^3$ final answer	**2**	**M1** for $[3\log(2x) =]\ \log(2x)^3$ oe

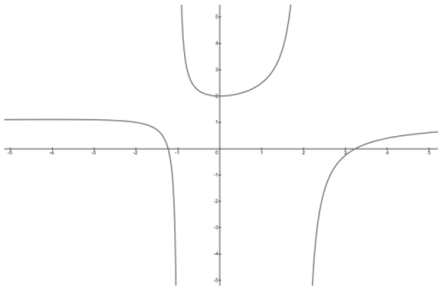
06. 0607_s24_ms_43 Q: 5

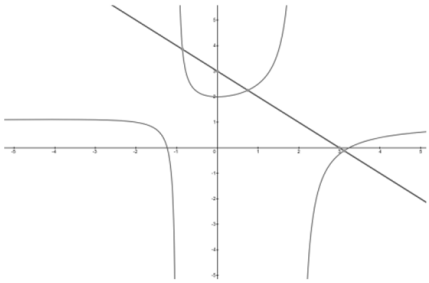
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**2**	With minimum in 3rd quadrant and maximum in 1st quadrant **B1** for any cubic with negative x^3
(b)	–4.19 or –4.193 to –4.192 –1 1.19 or 1.192 to 1.193	**3**	**B1** for each or **B1** for –1 and **B1** for –4.2 and 1.2
(c)	(–2.9[0], –10.1) or (–2.897 to –2.896, –10.05...)	**2**	**B1** for each coordinate
(d)	*their* –2.9[0] < a < 0.23[0]	**2**	–2.896 to 2.897 , 0.2301... **B1** for 0.23[0] seen or *their* –2.9[0] < a < k
(e)	Integer $\leqslant$ –11 or $\geqslant$ 6	**1**	

07. 0607_s24_ms_43 Q: 10

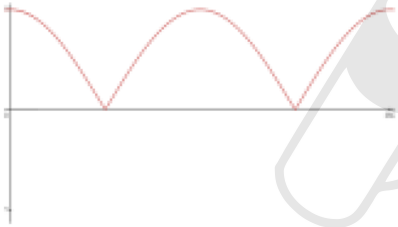
Question	Answer	Marks	Partial Marks
(a)	$3\frac{1}{2}$ oe	1	
(b)	6	2	**M1** for $5-\frac{1}{2}x=2$
(c)	$3\frac{1}{2}-1\frac{1}{2}x$ or $\frac{7-3x}{2}$ oe Final answer	2	**M1** for $5-\frac{1}{2}(3(x+1))$ oe
(d)	$\frac{x-3}{3}$ oe Final answer	2	**M1** for $x=3(y+1)$ or $x+1=\frac{y}{3}$ or $y-3=3x$
(e)	1	2	**B1** for h(90) or **M1** for sin(3(x + 1)) oe
(f)	sin(3(x + 1)) soi	1	
	Correct sketches e.g. 	2	or a single graph of h(g(x)) – 1 + 0.01x **B1** for each graph
	17.5 or 17.52... 48.7 or 48.71... 115.9 or 115.94...	2	**B1** for 1 correct.

08. 0607_m23_ms_42 Q: 6

Question	Answer	Marks	Partial Marks
(a)		4	**B4** for fully correct curve or **B3** for 'correct' curve with overlaps. or **B2** for 2 sections correct or **B1** for 1 section correct
(b)	$x=-1, x=2$	2	**B1** for each
(c)	(0, 2)	1	

Question	Answer	Marks	Partial Marks
(d)		**1**	Must intersect curve 3 times
(e)(i)	$x = -0.861$ or $-0.8608\ldots$ $x = 0.746$ or $0.7458\ldots$ $x = 3.11$ or 3.114 to 3.115	**2**	**B1** for one correct If 0 scored **SC1** for –0.86, 0.75, 3.1
(e)(ii)	$-1 < x < -0.861$ $0.746 < x < 2$ $x > 3.11$	**3**	**FT** *their* **(i)** **B1** for each

09. 0607_s23_ms_41 Q: 3

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**2**	**B1** for correct shape but inaccurate or different domain
(b)	90, 270	**2**	**B1** for each –1 if y cords (0) included
(c)(i)	60, 120, 240, 300	**2**	**B1** for two or three correct with no extras or four correct with extras –1 if y cords (0.5) included
(c)(ii)	$60 < x < 120$, $240 < x < 300$	**2**	**B1** for each
(c)(iii)	Correct areas shaded, i.e. below $y = 0.5$ and above $y = f(x)$	**1**	
(d)	0 [$< k <$] 1	**1**	

10. 0607_s23_ms_41 Q: 6

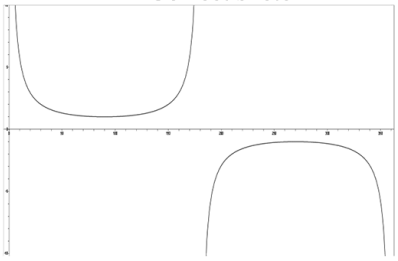
Question	Answer	Marks	Partial Marks
(a)	6	1	
(b)	100	2	**M1** for h((2 + 1)^2) oe or ((*x* + 1)^2 + 1)^2
(c)	4 – 2*x* or 2(2 – *x*) final answer	2	**M1** for 3 – 2*x* + 1
(d)	$\frac{3-x}{2}$ oe final answer	2	**M1** for $y + 2x = 3$ or for $\frac{y}{2} = \frac{3}{2} - x$ or for $x = 3 - 2y$ or $y - 3 = -2x$ or $\frac{3-y}{2}$ oe
(e)	3.73 or 3.732… or $2+\sqrt{3}$	2	**M1** j(75) oe

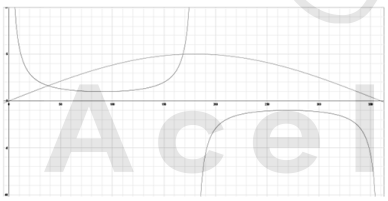
11. 0607_s23_ms_42 Q: 11

Question	Answer	Marks	Partial Marks
(a)	1	1	
(b)	–2	3	**B2** for –6*x* = 12 oe or better or **M1** for 2(1 – 3*x*) + 5 = 19
(c)	$\frac{1-x}{3}$ oe Final answer	2	**M1** for $x = 1 - 3y$ or $y + 3x = 1$ or $\frac{y}{3} = \frac{1}{3} - x$ or $y - 1 = -3x$

Question	Answer	Marks	Partial Marks
(d)	$\frac{1-5y}{2y+3}$ oe Final answer	3	**M1** for *y*(2*x* + 5) = 1 – 3*x* oe **M1FT dep** for 2*xy* + 3*x* = 1 – 5*y* dependent on 4 term equation with 2 terms in *x*. **M1FT** for factorising and dividing to form $\frac{a+by}{c+dy}$ Max 2 marks if final answer is incorrect.

12. 0607_w23_ms_41 Q: 2

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	3	Two branches with small gap at approx $x = 180$ **B2** for two correct shaped branches but with large gap or too much overlap or **B1** for one correct branch
(b)	(90, 1)	1	
(c)	$x = 180$ $x = 0$ and x = 360	2	**B1** **B1** If 0 scored, **SC1** for all 3 values seen
(d)	$-1 < k < 1$	2	**B1** for each If 0 scored, **SC1** for $-1 \leqslant k \leqslant 1$

Question	Answer	Marks	Partial Marks
(e)	38[.0] or 37.95... AND 168 or 168.4... 	3	**B1** for either solution correct or **B1** for both solutions expressed in coordinate form AND **B1** Correct sine curve through (0, 0), (360, 0) and with amplitude approximately 5

13. 0607_w23_ms_41 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	$\begin{pmatrix}-7\\0\end{pmatrix}$	2	**B1** for each or for $\begin{pmatrix}-10\\2\end{pmatrix}$ seen
(a)(ii)	(5, 4)	1	
(a)(iii)	5.1[0] or 5.099...	2	**M1** for $(-5)^2 + 1^2$ oe
(b)	$\begin{pmatrix}-2\\2\end{pmatrix}$	2	**B1** for each
(c)(i)	Translation $\begin{pmatrix}2\\-5\end{pmatrix}$	2	**B1** for each
(c)(ii)	Rotation 90° [anticlockwise] oe (0, 2)	3	**B1** for each
(c)(iii)	Image at (–1, 1) (–3, 1), (–1, 2)	1	
(c)(iv)	Image at (1, 0), (1, –3), (3, –3)	2	**B1** for stretch factor 3 in $y = k$ or in $x = 3$

14. 0607_w23_ms_41 Q: 5

Question	Answer	Marks	Partial Marks
(a)	$-5 \leqslant f(x) \leqslant 15$	2	**B1** for each If 0 scored, **SC1** for -5 and 15 seen
(b)(i)	1.5 oe	2	**M1** for $2x = -2 + 5$

Question	Answer	Marks	Partial Marks
(b)(ii)	–2 and 0	3	**B2** for $x^2 + 2x = 0$ oe or **M1** for $x^2 + x + 3 = 3 - x$
(c)	15	2	**B1** for f(4) = 3 stated or used twice or **M1** for $(2x - 5)^2 + (2x - 5) + 3$ oe
(d)	–1	2	**M1** for $2^3 - 3^2$ oe
(e)	$\sqrt[3]{x}$ oe	1	
(f)	$\log_3 x$ or $\frac{\log x}{\log 3}$	2	**M1** for $x = \log_3 y$ or $x = \frac{\log y}{\log 3}$ or for $x = 3^y$

15. 0607_w23_ms_41 Q: 7

Question	Answer	Marks	Partial Marks
(a)	8	**3**	**B2** for $x + 2x = 10 + 14$ or better or **M1** for $x + 2(x – 5) = 14$ oe
(b)(i)	$\frac{5}{y}+\frac{7}{y-7}=2$ oe	**M1**	
	$5(y – 7) + 7y = 2y(y – 7)$	**M1**	**dep** fractions correctly cleared dependent on equation with two different linear denominators
	leading to $2y^2 – 26y + 35 = 0$	**A1**	No errors or omissions

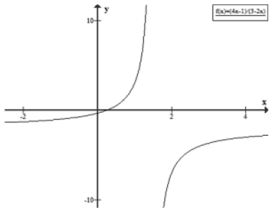
Question	Answer	Marks	Partial Marks
(b)(ii)	1.53 or 1.525... AND 11.5 or 11.47...	**3**	**M2** for $\frac{26 \pm \sqrt{(-26^2) - 4(2)(35)}}{2(2)}$ or correct shaped graph with 2 intersections on the positive x-axis or **M1** for $\sqrt{(-26)^2 - 4(2)(35)}$ or for $\frac{26 + (\text{or } -)\sqrt{p}}{2(2)}$ If 0 scored, **SC2** for 2 correct solutions given in surd form or **SC1** for 1 correct solution
(b)(iii)	4.5 or 4.47...	**1**	**FT** *their* positive solution – 7, provided final answer positive

16. 0607_w23_ms_42 Q: 2

Question	Answer	Marks	Partial Marks
(a)(i)	10	1	
(a)(ii)	28	1	
(b)	−5	1	
(c)	$\frac{x-4}{2}$ oe	2	**M1** for $2x = y - 4$ or $x = 2y + 4$ or $\frac{y}{2} = x + \frac{4}{2}$
(d)	$2x^2 + 2x - 3$	2	**M1** for $2x^2 + 4x - 2x - 4$ [+1]
(e)	$[x =]1$ and $[x =]4$	3	**M1** for $(x-1)^2 - 3(x-1)$ or better **M1** for $(x-1)(x-4) = 0$ or **dep M1** for correct use of formula on *their* quadratic equation or **dep M1** for sketch of their quadratic equation clearly showing 2 intersections with x-axis

17. 0607_w23_ms_43 Q: 10

Question	Answer	Marks	Partial Marks
(a)(i)	9	1	
(a)(ii)	–33	2	**B1** for [h(4)] = –8 or **M1** for $4 \times 4(2-4) - 1$
(a)(iii)	$5 - 8x$ final answer	2	**M1** for $3 - 2(4x - 1)$ or better
(a)(iv)	$2 - \frac{x}{4}$ oe final answer	2	**M1** for $x = 4(2 - y)$ or $\frac{y}{4} = 2 - x$ or $y - 8 = -4x$

Question	Answer	Marks	Partial Marks
(b)(i)	Correct sketch 	3	**B2** for correct left-hand branch or **B1** for left-hand branch with a positive y-intercept or passing through origin AND **B1** for correct right-hand branch
(b)(ii)	$x = 1.5$ oe	1	
(b)(iii)	1.06 or 1.064 to 1.065 2.94 or 2.935...	3	**B2** for one correct or **M1** for sketch of $y = 4(2 - x)$
(b)(iv)	8, –32, 25	3	**B2** for 2 correct OR **M1** for $4(2-x)(3-2x) = 4x - 1$ **B1** for $6 - 7x + 2x^2$ or $24 - 28x + 8x^2$

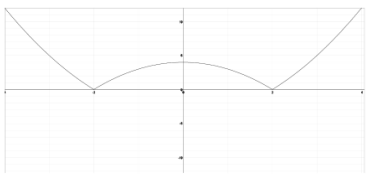
18. 0607_w21_ms_43 Q: 12

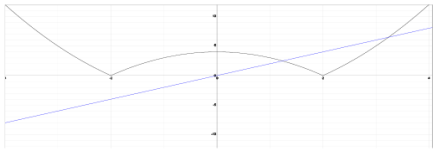
Question	Answer	Marks	Partial Marks
(a)(i)	–0.5 oe	3	**M2** for $\frac{x}{2} = -\frac{1}{4}$ or $4x = -2$ or **M1** for $\frac{2}{x} = 5 - 9$ oe or $9x = 5x - 2$ oe
(a)(ii)	$4 < x < 6$	3	**B2** for $x < 6$ seen and not spoiled or **B1** for [x =] 6 seen OR **M2** for $\frac{6 - 3x + 12}{x - 4}$ [> 0] or **M1** for $\frac{3(x-4)}{x-4}$ soi OR **M2** for correct graph showing answers or **M1** for appropriate graph
(b)(i)	0.219 2.28	3	**B2** for 0.2192... or 0.22 and 2.280 to 2.281 or **M1** for correct curve or correct use of formula
(b)(ii)	12.4 or 12.35 to 12.36... 66.3 or 66.31 to 66.33	2	**B1** for each **FT** *their* **(b)(i)**

19. 0607_s15_ms_41 Q: 5

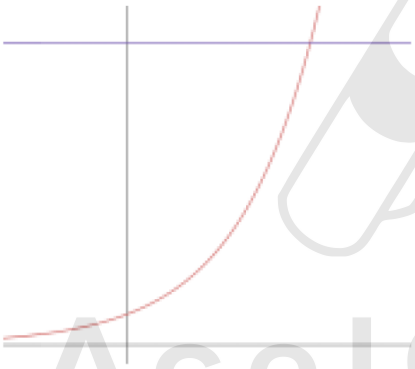
Qu.	Answer	Mark	Part Marks
(a) (i)	3	2	**M1** for $y = \frac{k}{\sqrt{x}}$ or $\frac{y}{5} = \frac{\frac{1}{\sqrt{25}}}{\frac{1}{\sqrt{9}}}$ oe If 0 scored, **SC1** for 0.648 oe or $\frac{25}{3}$ oe
(ii)	0.36 oe	2FT	**FT** $\left(\frac{their\ k}{25}\right)^2$ only from correct variation, $k \neq 1$ **B1** for $\left(\frac{their\ k}{25}\right)$ oe soi $k \neq 1$ If 0 scored, **SC1** for 4.02 or 4.024 to 4.025 or 225
(iii)	$x = \frac{225}{y^2}$ or $\left(\frac{15}{y}\right)^2$	2	**M1** for $x = \frac{c}{y^2}$ or $\sqrt{x} = \frac{their\ k}{y}$ oe $k \neq 1$ If 0 scored, **SC1** for $\sqrt{\frac{405}{y}}$ or $\frac{9y^2}{25}$
(b)	$y = -3(x-2)(x+4)$ or $-3x^2 - 6x + 24$	3	**M2** for [$y =$] $k(x-2)(x+4)$, $k \neq 1$ soi or **M1** for $(x-2)(x+4)$ seen OR **M1** for $k(x+1)^2 + c$, $k \neq 1$ and **M1** for substituting two points to get $24 = k + c$ and $0 = 9k + c$ OR **M1** for 3 correct equations in $y = ax^2 + bx + c$ and **M1** for eliminating one variable from all three equations. If 0 scored, **SC1** for $ax^2 + bx + 24$ soi

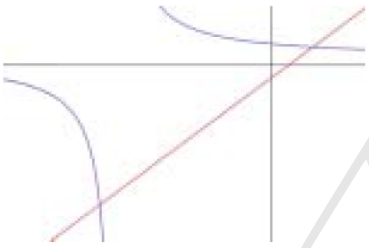
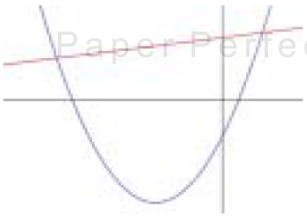
20. 0607_m22_ms_42 Q: 7

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**M1** for a modulus graph or for graph of $y = 4 - x^2$
(b)	–2, 2	2	**B1** for each If 0 scored, **SC1** for (2, 0) and (–2, 0)

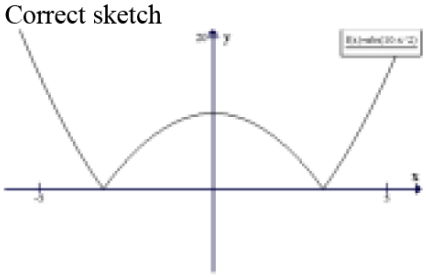
Question	Answer	Marks	Partial Marks
(c)	(0, 4)	**1**	
(d)	1 or 2 or 3	**1**	
(e)(i)	Correct sketch 	**1**	
(e)(ii)	1.24 or 1.236..., 3.24 or 3.236...	**2**	**B1** for each or **B1** for both seen e.g. $1.24 \leqslant x \leqslant 3.24$ or with y coords included or for 1.23 and 3.23
(e)(iii)	Two correct regions above x-axis and below both graphs	**2**	**B1** for one correct and no wrong or for one correct and one incomplete

21. 0607_s21_ms_41 Q: 11

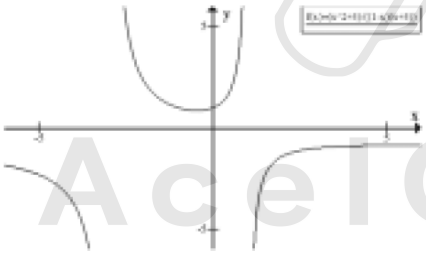
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**M2**	or **M1** for exponential graph
	1.43 or 1.430 to 1.431	**B1**	

Question	Answer	Marks	Partial Marks
(b)	Algebraic method		
	$(6x-1)(2x+3)=[5+x]$ or better	**M1**	
	$12x^2+15x-8=0$	**A1**	
	$x=\dfrac{-15\pm\sqrt{15^2-4\times12\times-8}}{2\times12}$	**M1**	Correct use of formula or correct sketch of parabola
	0.403 or 0.4032…	**B1**	
	–1.65 or –1.653…	**B1**	
(b)	Graphical method (1)		
	Correct sketch of $y = 6x - 1$	**M1**	
	Correct sketch of $y=\dfrac{5+x}{2x+3}$ 	**M2**	or **M1** for hyperbolic graph
	0.403 or 0.4032…	**B1**	
	–1.65 or –1.653…	**B1**	
(b)	Graphical method (2)		
	Correct sketch 	**M3**	**M2** for parabola $y = (6x - 1)(2x + 3)$ oe or **M1** for parabola and **M1** for $y = 5 + x$
	0.403 or 0.4032...	**B1**	
	–1.65 or –1.653...	**B1**	

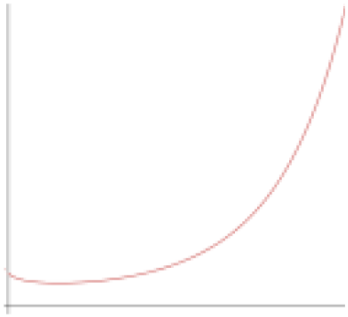
22. 0607_s21_ms_42 Q: 4

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for correct middle section
(b)	± 4 ± 2	2	**B1** for 2 correct solutions
(c)	$x < -4$ $-2 < x < 2$ $x > 4$	3	**B1** for each
(d)	0 $[k] > 10$	2	**B1** for each

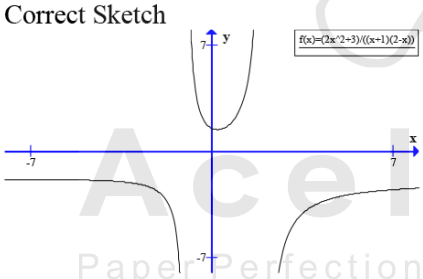
23. 0607_s21_ms_42 Q: 13

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	3	**B1** for each branch
(b)	$x = 1$, $x = -3$	2	**B1** for each
(c)	–3.79 or –3.791... –1 0.791 or 0.7912 to 0.7913	3	**B1** for each If 0 scored **SC1** for $y = 2x + 3$ sketched and cutting both axes

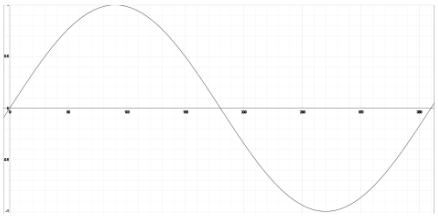
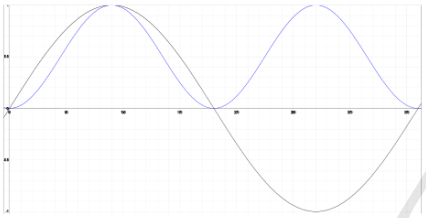
24. 0607_s21_ms_43 Q: 9

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for correct shape but cutting either axis or without minimum
(b)	(0.368, 0.692) or (0.3678 to 0.3679, 0.6922...)	2	**B1** for each
(c)(i)	0.237 or 0.2369 to 0.2370 2.31 or 2.311....	3	**M1** for correct line sketched **B1** for one correct
(c)(ii)	[0 <] $x \leqslant$ 0.237 or 0.2369 to 0.2370 $x \geqslant$ 2.31 or 2.311…	2	**B1** for each

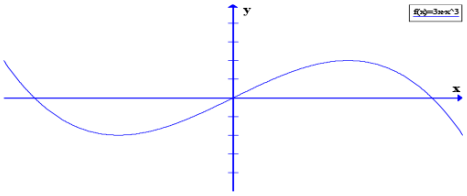
25. 0607_w21_ms_41 Q: 5

Question	Answer	Marks	Partial Marks
(a)	Correct Sketch 	3	**B1** for each branch
(b)	$x = -1, x = 2$	2	**B1** for each
(c)	(0.208, 1.43)	2	0.2080 to 0.2081, 1.425 to 1.426 **B1** for each coordinate
(d)	$-1 < x < 0.208$	B2	**FT** *their* **5(c)** **B1** for $-1 < x$ or $x < 0.208$
	$x < -1$ oe	B1	
(e)	3.75 or 3.747...	1	

26. 0607_w21_ms_42 Q: 2

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for sine curve but different period and/or different amplitude
(b)	(270, –1)	1	
(c)	360 1	2	**B1** for each
(d)	Correct sketch 	2	**B1** for $(\text{sine})^2$ curve but different period and/or different amplitude
(e)(i)	$-1 \leqslant f(x) \leqslant 1$	1	
(e)(ii)	$0 \leqslant g(x) \leqslant 1$	1	
(f)	Correct shading	1	

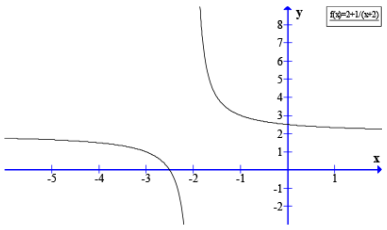
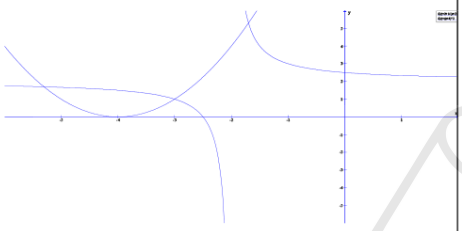
27. 0607_w21_ms_43 Q: 8

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for negative cubic graph with 2 turning points
(b)	(1, 2)	1	
(c)	–1.73 or –1.732… oe 0 1.73 or 1.732… oe	2	**B1** for two correct
(d)(i)	Translation $\begin{pmatrix}-1\\0\end{pmatrix}$	2	**B1** for each
(d)(ii)	–1.46 or –1.457… 0.457 or 0.4574…	2	**B1** for each but without y-coords. or **M1** for graph of $y=3(x+1)-(x+1)^3$ oe
(d)(iii)	[–2 ⩽] x ⩽ –1.46 0.457 ⩽ x [⩽ 2]	2	**B1** for each or for x ⩽ –1.46 and 0.457 ⩽ x

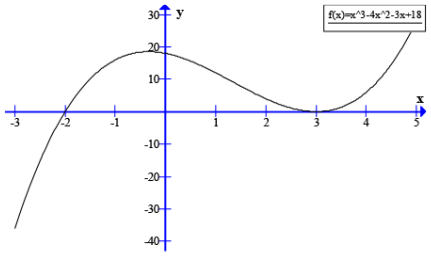
28. 0607_s20_ms_41 Q: 9

Question	Answer	Marks	Partial Marks
(a)	Correct curve 	2	**B1** for correct shape but inaccurate x intercepts
(b)	[–0.5 <] x < 0	1	
	2 < x < 4	2	**B1** for 2 < x oe or for x < 4 oe
(c)	3.08 or 3.079...	2	**M1** for identifying local maximum point

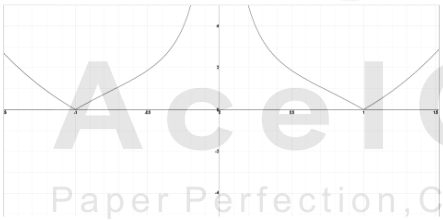
29. 0607_s20_ms_42 Q: 7

Question	Answer	Marks	Partial Marks
(a)(i)		2	**B1** for correct 'hyperbolic shape' **B1** for intersects with axes correct (approx.)
(a)(ii)	(–2.5, 0) (0, 2.5)	2	**B1** for each
(a)(iii)	$x = -2$ $y = 2$	2	**B1** for each
(b)		2	**B1** for correct 'quadratic shape' **B1** for min point at (–4, 0) (approx.)
(c)	$[x =] -5.30$ $[x =] -3$ $[x =] -1.70$	3	**B1** for each correct answer
(d)	$-5.30 \leq x \leq -3$ and $-2 < x \leq -1.70$	2	**B1** for each

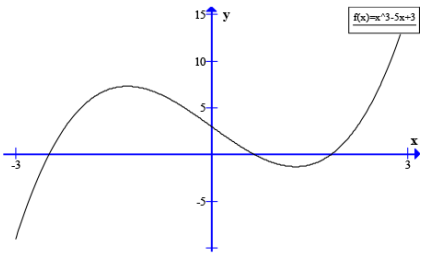
30. 0607_s20_ms_43 Q: 4

Question	Answer	Marks	Partial Marks
(a)	Correct Sketch 	**2**	With maximum in second quadrant and minimum on positive x-axis **B1** for cubic graph for +ve x^3
(b)	–1.51 or –1.508 to –1.507 1.24 or 1.244... 4.26 or 4.263 to 4.264	**3**	**B1** for each
(c)(i)	(–0.333, 18.5) or (–0.3333..., 18.51 to 18.52)	**2**	**B1** for each coordinate
(c)(ii)	(3, 0)	**1**	
(d)	$k < 0$, $k > 18.5$	**2**	**B1FT** for each

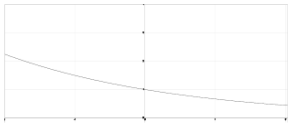
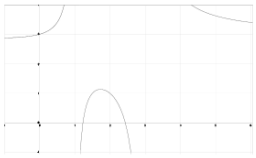
31. 0607_w20_ms_41 Q: 7

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**3**	**B1** for modulus graph **B1** for correct for $x > 1$, or $-1 < x < 0$ **B1** for $x = -1$ and 1 when $y = 0$ plotted correctly. Maximum 2 marks if sketch not fully correct
(b)	$x = 0$	**1**	
(c)	–1.4[0] or –1.395… –0.475 or –0.4746…	**2**	**B1** for each
(d)	$-1.15 \leqslant x \leqslant -0.536$ or —1.154 to –1.153...$\leqslant x \leqslant$ –0.5357 to –0.5356 AND $0.536 \leqslant x \leqslant 1.15$ or 0.5356 to 0.5357 $\leqslant x \leqslant$ 1.153 to 1.154	**3**	**B2** for one fully correct inequality or **B1** for $-1.15 \leqslant x \leqslant -k$ $-k \leqslant x \leqslant -0.536$ or $0.536 \leqslant x \leqslant k$ $k \leqslant x \leqslant 1.15$ or **M1** for suitable sketch, e.g. $f(x) + x^2 \leqslant 2$ or **B1** for 4 correct solutions seen

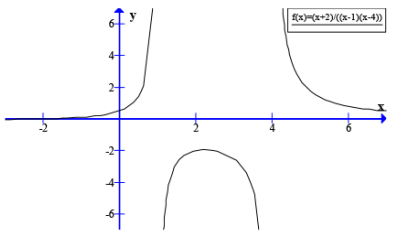
32. 0607_w20_ms_42 Q: 4

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**2**	Cubic curve, crossing x-axis three times, with maximum in 2nd quadrant and minimum, in 4th quadrant **B1** for any cubic (positive x^3)
(b)	(1.29, –1.3[0])	**2**	1.290 to 1.291, –1.303... **B1** for each coordinate
(c)	Rotation [Order] 2 [centre] (0, 3)	**3**	**B1** for each
(d)(i)	–2.9[0] or –2.895... 0.603 or 0.6027... 2.29 or 2.292...	**3**	**B1** for each If three correct but seen in coordinate form, **SC1**. If 0 scored, **SC1** for correct sketch of line (may be freehand but negative intersection with y-axis and crosses curve three times)
(d)(ii)	$-2.9[0] < x < 0.603$ $x > 2.29$	**2**	**FT** *their* **(i)** **B1** for each

33. 0607_w20_ms_43 Q: 8

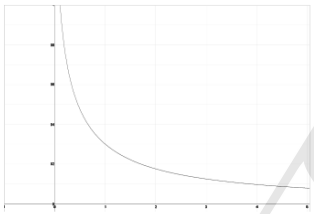
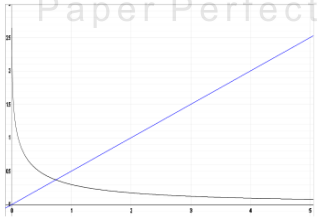
Question	Answer	Marks	Partial Marks
(a)(i)	Correct sketch 	2	**B1** for exponential shape
(a)(ii)	$0 \leqslant x \leqslant 1.71$ or 1.709 to 1.710	3	**B2** for either correct or **B1** for 0 and 1.71 or 1.709 to 1.710 seen
(a)(iii)	–1.3[0] or –1.302... 0.843 or 0.8429...	3	**B2** for one correct or **B1** for sketch of $y = x^2$ added to diagram 
(a)(iv)	Two areas shaded which are above $y = 1.5^{-x}$ and below $y = x^2$	1	
(b)	$[a =] -2$ $[b =] -4$	3	**B1** for $a = -2$ **M1** for $\frac{b}{a} = 2$ oe
(c)	Correct sketch 	3	**B1** for each branch

34. 0607_s19_ms_41 Q: 11

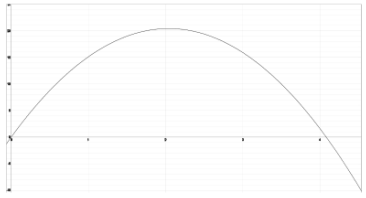
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	3	**B1** for each branch

Question	Answer	Marks	Partial Marks
(b)	(2.24, –1.94)	**2**	or (2.242 to 2.243, –1.943 to –1.942) **B1** for each co-ordinate
(c)	$x = 1$, $x = 4$, $y = 0$	**3**	**B1** for each
(d)(i)	1.34 or 1.344 to 1.345 2.79 or 2.789... 5.87 or 5.866...	**3**	**B1** for each If 0 scored, **SC1** for 1.3, 2.8 and 5.9
(d)(ii)	$x < 1$ $1.34 < x < 2.79$ $4 < x < 5.87$	**3**	**B1** for each **FT** dep on two solutions to **(i)** between 1 and 4. **FT** dep on solution to **(i)** > 4

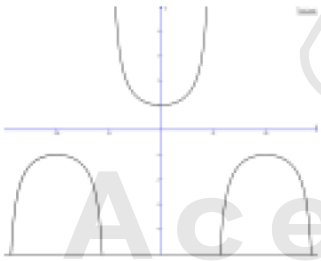
35. 0607_s19_ms_42 Q: 2

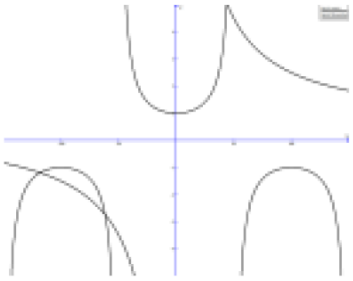
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**2**	Must not cross axes **B1** for correct shape
(b)	$y = 0$, $x = 0$	**2**	**B1** for each If 0 scored, **SC1** for answers x-axis and y-axis
(c)	0.462 or 0.4624 to 0.4625	**1**	
(d)	Correct sketch 	**1**	
(e)	0.742 or 0.7415 to 0.7416	**1**	
(f)	Region that is below $y = 0.5$ and above other two graphs.	**1**	

36. 0607_s19_ms_42 Q: 7

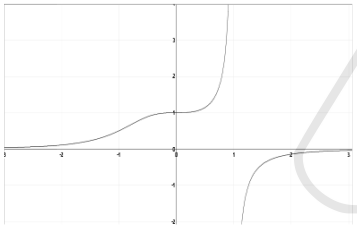
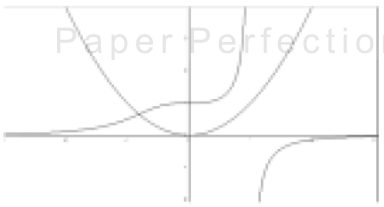
Question	Answer	Marks	Partial Marks
(a)	15.1	**1**	
(b)(i)	Correct sketch 	**2**	Must pass through origin and cross x-axis reasonably close to $x = 4$, not 4.5. **B1** for correct shape
(b)(ii)	[h =]20.4 or 20.40 to 20.41 [t =] 2.04 or 2.040 to 2.041	**2**	**B1** for each or both correct reversed answers
(b)(iii)	4.08 or 4.081 to 4.082	**1**	
(b)(iv)	1.4[0] or 1.401 to 1.403	**3**	**B1** for 2.74 or 2.741 to 2.742 **B1** for 1.34 or 1.339 to 1.340

37. 0607_s19_ms_43 Q: 4

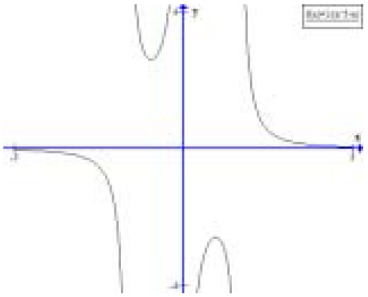
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**3**	**B1** for correct shape **B1** for max and min approx. correct **B1** for asymptotes approx. correct
(b)	$f(x) \leqslant -1$ and $f(x) \geqslant 1$	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
(c)(i)	Correct sketch 	2	**B1** for each branch
(c)(ii)	–213 or –212.9 to –212.8 –111 or –111.5 to –111.4 78.6[…]	3	**B1** for each
(c)(iii)	$x = 0$ $y = 0.5$	2	**B1** for each

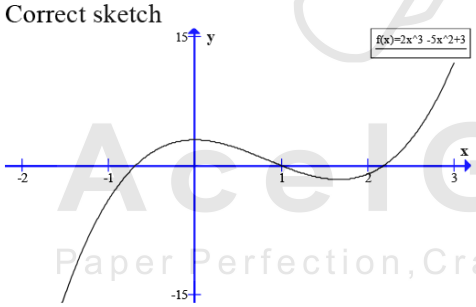
38. 0607_w19_ms_41 Q: 3

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	3	**B2** for first branch correct, including gradient zero at y-intercept or **B1** for first branch above x-axis, increasing and crossing y-axis **B1** for second branch correct
(b)	0.0357 or $0.03571... \leqslant f(x) \leqslant 1$ oe	2	**B1** for $0 < f(x)$ or $f(x) \leqslant 1$
(c)	Correct sketch 	1	Vertex at origin
(d)(i)	–[0].809 or –[0].8087...	1	
(d)(ii)	[u =] 5 [w =] 2	2	**B1** for each or **SC1** for answers reversed

39. 0607_w19_ms_42 Q: 12

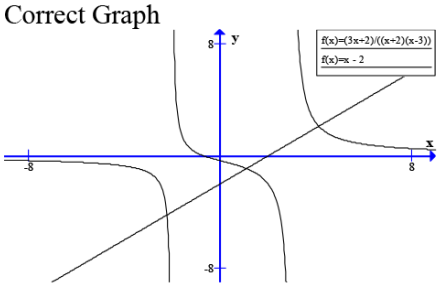
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	4	**B1** for each branch
(b)	$x = 0$ $x = 1$ $x = -1$ $y = 0$	3	**B2** for three correct or **B1** for one correct
(c)	(0.577, –2.6[0]) or (0.5773 to 0.5774, –2.598…)	2	**B1** for each
(d)	[x =] –1.24 or –1.242 to –1.241 [x =] 1.13 or 1.127 to 1.128	2	**B1** for each

40. 0607_w19_ms_43 Q: 3

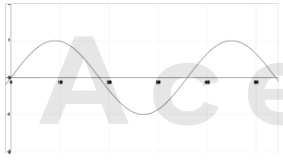
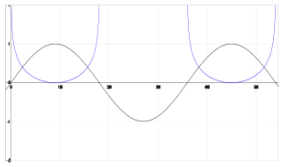
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for cubic curve (+ x^3) with 2 turning points
(b)	–0.686 or –0.6861..., 1, 2.19 or 2.186...	3	**B1** for each If 0 scored, **SC1** for three correct but in coordinate form (…, 0)
(c)	(0, 3)	1	

Question	Answer	Marks	Partial Marks
(d)	(1.67, –1.63) or (1.666 to 1.667, –1.630 to –1.629)	2	**B1** for each co-ordinate
(e)	$-1.63 < k < 3$	2	**FT** *their y* co-ords from **(c)** and **(d)** **B1** for each

41. 0607_w19_ms_43 Q: 12

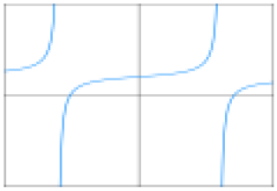
Question	Answer	Marks	Partial Marks
(a)	Correct Graph 	3	**B1** for each branch
(b)	$x = -2$ $x = 3$ $y = 0$	3	**B1** for each
(c)(i)	Correct line , See **(a)**	1	
(c)(ii)	–2.21 or –2.211... 1.1[0] or 1.100... 4.11 or 4.111...	3	**B1** for each
(c)(iii)	$x < -2.21$ $-2 < x < 1.1[0]$ $3 < x < 4.11$	3	**FT** from **(ii)** if graphs are correct **B1** for each

42. 0607_s18_ms_41 Q: 5

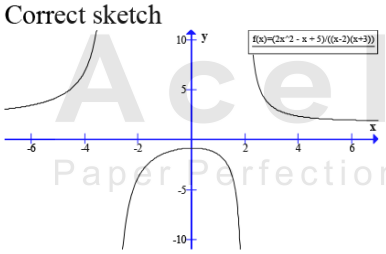
Question	Answer	Marks	Partial Marks
(a)(i)	Correct sketch 	2	**B1** for sine graph with different amplitude and/or period but must go through (0, 0) or for correct sine graph but only one cycle
(a)(ii)	$-1 \leqslant f(x) \leqslant 1$	1	
(b)(i)	Correct sketch 	2	i.e. Correct shape with 2 branches above x-axis and gap of at least 120 between the branches and only slightly crossing either axis. **B1** for 2 branches above x-axis but gap less than 120 between the branches and only slightly crossing either axis or one branch correct
(b)(ii)	logarithms of negative numbers do not exist oe	1	
(b)(iii)	(90, 0), (450, 0)	2	**B1** for each
(b)(iv)	$x = 0$, $x = 180$, $x = 360$, $x = 540$	2	**B1** for 2 or 3 correct

Question	Answer	Marks	Partial Marks
(c)(i)	23.5 or 23.51 to 23.52	**1**	
(c)(ii)	$23.5 < x < 156.5$ $383.5 < x < 516.5$	**2**	**B1** for each Allow 23.51 to 23.52, 156.48 to 156.49 Allow 383.51 to 383.52, 516.48 to 516.49
(c)(iii)	Any integer less than – 1	**1**	

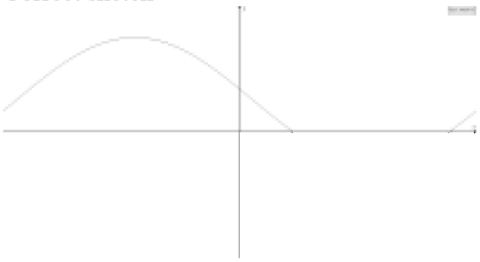
43. 0607_s18_ms_42 Q: 2

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**3**	**B1** for each branch
(b)	$y = 1$, $x = 3$, $x = -3$	**3**	**B1** for each
(c)	–2.87 or –2.874 to –2.873 1.15 or 1.149 to 1.150 2.72 or 2.723 to 2.724	**3**	**B1** for each If 0 scored **SC1** for –2.9, 1.1 and 2.7

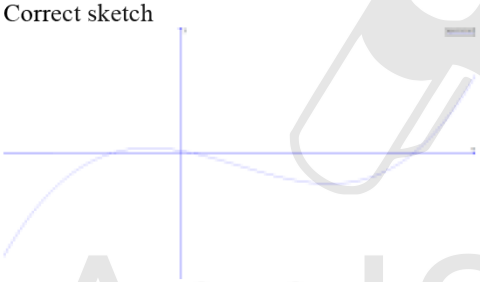
44. 0607_s18_ms_43 Q: 5

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**3**	**B1** for each branch
(b)	(0.0295, – 0.833)	**2**	or (0.02948 to 0.02949, –0.8329...) **B1** for each
(c)	$x = -3$, $x = 2$, $y = 2$	**3**	**B1** for each
(d)	$-0.833 < k \leqslant 2$	**2**	**FT** *their* **(b)** **B1** for each inequality
(e)(i)	–5.13, 2.81	**2**	–5.131..., 2.812 to 2.813 **B1** for each
(e)(ii)	$-5.13 < x < -3$, $2 < x < 2.81$	**2**	–5.131..., 2.812 to 2.813 **B1** for each **FT** *their* **(c)** and **(e)(i)**

45. 0607_w18_ms_41 Q: 3

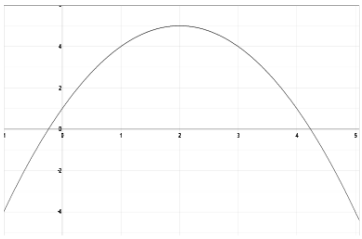
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	3	Intersections with x-axis both positive and not 90 and maximum below 4 **B1** correct sine graph shape **B1** max and min in correct quadrant
(b)	(20, 0) (80, 0)	2	**B1** for each
(c)	(–40, 3)	1	
(d)	–80.2 or –80.16… 28.9 or 28.90… 56.7 or 56.71 to 56.72	3	**B1** for each

46. 0607_w18_ms_41 Q: 9

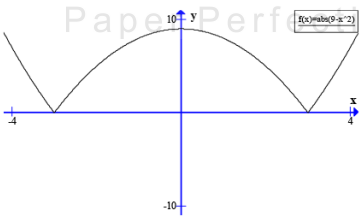
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for cubic graph with max/min incorrect
(b)	(2.53, –12.1)	2	**B1** for each co-ordinate
(c)	$k < -12.1$ $k > 2.13$	2	**B1** for each **FT** *their* –12.1

Question	Answer	Marks	Partial Marks
(d)	$-0.726 < x < 1.26$	2	**B1** for both critical values seen or for $[k <] x < 1.26$ or for $-0.726 < x [< k]$

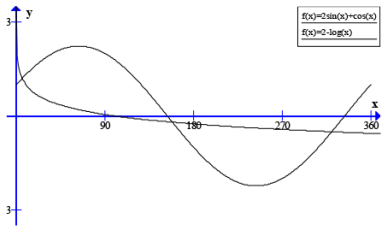
47. 0607_w18_ms_43 Q: 8

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	**B1** for parabola vertex upwards but incorrect intersections with axes
(b)	$x = 2$ oe	1	
(c)(i)	– 0.236 or – 0.2361 to – 0.2360 4.24 or 4.236…	2	**B1** for each
(c)(ii)	– 0.236 or – 0.2361 to – 0.2360 < x < 4.24 or 4.236…	1	**FT** *their* **(b)(i)**
(d)	– 0.449 or – 0.4495 to – 0.4494 4.45 or 4.449…	2	**B1** for each If 0 scored, **B1** for $y = -1$ sketched
(e)	Correct line sketched, passing through (5, 0)	2	**B1** for line with negative gradient or with y-intercept reasonably close to 5 but not through (0, 6)
(f)	Region below curve **and** below line shaded, **continuing** below x-axis	1	

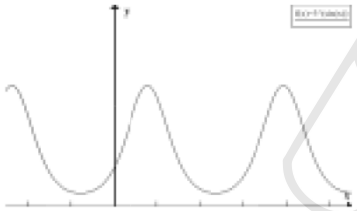
48. 0607_s17_ms_41 Q: 7

Question	Answer	Marks	Partial Marks
(a)	Correct Graph 	4	**B1** for maximum point on or close to y-axis **B1** for correct shape between *their* –3 and 3 **B1** for mod graph
(b)	[x =] ±4, ± $\sqrt{2}$ or ± 1.41 or ± 1.414...	2	**B1** for any 2 correct answers
(c)	$k > 9$ $k = 0$	2	**B1** for each

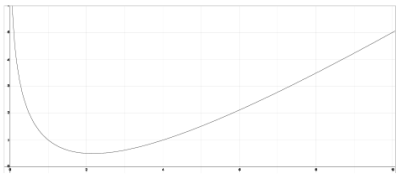
49. 0607_s17_ms_41 Q: 10

Question	Answer	Marks	Partial Marks
(a)	Correct Graph 	3	**M1** for sine graph with one max and one min **A1** for x-intercepts at 150 and 330 (approx.) **A1** for positive y-intercept
(b)	Correct Graph with second intersection with other graph (if correct) below x-axis	2	**M1** for correct shape
(c)	6.18 or 6.175... 159 or 158.5 to 158.6 320 or 320.3 to 320.4	3	**B1** for each

50. 0607_s17_ms_42 Q: 8

Question	Answer	Marks	Partial Marks
(a)	 Correct sketch	3	With correct shape with two max on right of y-axis and one on left, all above x-axis and reasonable quality or **B2** for correct shape and all above x-axis or **B1** for correct shape
(b)	–270, 90, 450	3	**B1** for each **SC2** for all correct but with y co-ords or **SC1** for two correct with y co-ords
(c)	750, 870	2	**B1** for each
(d)	$x < 54.7$	1	54.74 to 54.75
	$164 < x < 267$	2	163.5 to 163.6 , 266.6... **B1** for one inequality or **B1** for both values seen If 0 scored, **B1** for straight line with negative gradient crossing curve three times between $x = 0$ and $x = 400$. May be freehand.

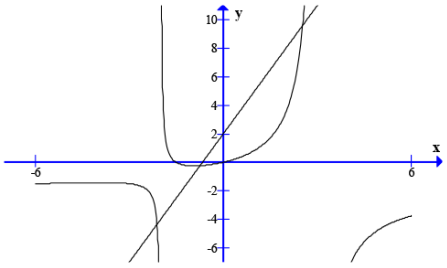
51. 0607_s17_ms_43 Q: 6

Question	Answer	Marks	Part Marks
(a)	Correct sketch 	2	**B1** for correct shape
(b)	(2.17, 0.488) or (2.171…, 0.4877…)	2	**B1** for each
(c)	$0.488 \leqslant f(x) \leqslant 1.51$ or $0.4877... \leqslant f(x) \leqslant 1.505...$	2	**FT** *their* 0.488 **B1** for $0.488 \leqslant f(x)$ oe or $f(x) \leqslant 1.51$ oe
(d)	0.502 or 0.5015… 5.83 or 5.827…	2	**B1** for each
(e)	$0.502 < x < 5.83$ or $0.5015... < x < 5.827...$	1	**FT** *their* (d)
(f)(i)	15.[0] or 15.00… 25.[0] or 25.00… 35. [0] or 35.00…	1	
(f)(ii)	[an] asymptote oe	1	

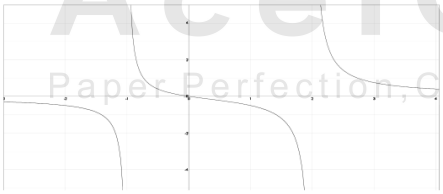
52. 0607_w17_ms_41 Q: 10

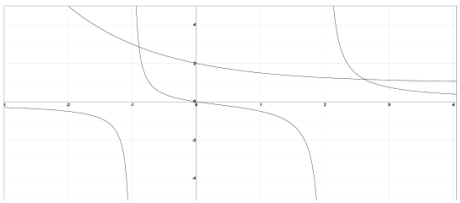
Question	Answer	Marks	Partial Marks
(a)	$8 - 3x$ final answer	1	
(b)(i)	$x^2 + (\textit{their}\ (8 - 3x))^2 = 25$	M1	
	$64 - 24x - 24x + 9x^2$	B1	or *their* $(8 - 3x)^2$ expanded correctly
	Completion to $10x^2 - 48x + 39 = 0$	A1	
(b)(ii)	(1.04 or 1.036... , 4.88 to 4.89...) with working (3.76 or 3.763 to 3.764 ,–3.29.. to –3.28) with working	5	**M1** for $\frac{48 \pm \sqrt{(-48)^2 - 4(10)(39)}}{2 \times 10}$ or sketch of parabola with both zeros > 0 or sketch of circle centre O with straight line **B1** for each x co-ordinate **B1** for each y co-ordinate or **B1** , **B1** for correct pairs reversed

53. 0607_w17_ms_41 Q: 11

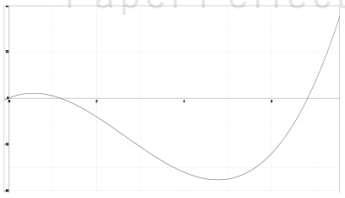
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	3	**B1** for each branch
(b)	(–0.93[0], –0.252) or (–0.9303..., 0.2521...)	2	**B1** for each co-ordinate
(c)	$x = -2$ final answer $x = 3$ final answer	2	**B1** for each
(d)(i)	–2.12 or –2.117... –0.747 or –0.7465... 2.53 or 2.530 to 2.531	3	**B1** for each
(d)(ii)	$x < -2.12$ $-2 < x < -0.747$ $2.53 < x < 3$	3	**FT B1** for each only if three answers in (i) and asymptotes used

54. 0607_w17_ms_42 Q: 4

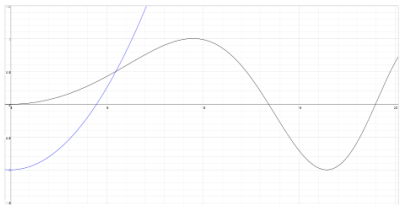
Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	3	**B1** for correct middle branch **B1** for correct left hand branch **B1** for correct right hand branch

Question	Answer	Marks	Partial Marks
(b)	-1 2	**2**	**B1** for each
(c)	2	**1**	
(d)(i)	Correct sketch 	**2**	Must intersect y-axis and be above x-axis **B1** for decreasing exponential graph
(d)(ii)	$y = 1$ oe	**1**	
(e)	-0.892 or -0.8919 to -0.892[0] 2.62 or 2.622 to 2.623	**2**	**B1** for each

55. 0607_w17_ms_42 Q: 7

Question	Answer	Marks	Partial Marks
(a)	$x+2\left(x+\frac{1}{4}\right)=8$ oe	**M2**	**M1** for $2\left(x+\frac{1}{4}\right)$ oe seen
	2.5	**B1**	
(b)(i)	$x^3 = 2x(x-2)(x-2)$ oe	**M1**	
	$[(x-2)^2 =]\ x^2-2x-2x+4$ or $2x^3-4x^2-4x^2+8x$	**B1**	Allow $-4x$ for $-2x-2x$ Allow $-8x^2$ for $-4x^2-4x^2$
	leading to $x^3-8x^2+8x=0$	**A1**	Final equation reached without any errors or omissions
(b)(ii)	Correct sketch 	**2**	**B1** for correct shaped cubic with max before min
(b)(iii)	318 or 319 or 318.3 to 318.7	**2**	**B1** for 6.83 or 6.828… seen isw use of other values (1.1715…)

56. 0607_s16_ms_42 Q: 6

Question	Answer	Mark	Part Marks
(a)	Correct sketch 	2	**M1** for shape i.e. starting at origin then one maximum then one minimum **A1** for two zeros to right of $x = 10$ and to the left of $x = 20$
(b)	13.4 or 13.41 to 13.42 19[.0] or 18.97…	1 1	
(c)	(9.49, 1) or (9.486 to 9.487, 1)	B1 B1	
(d)	(16.4, –1) or (16.43…, –1)	B1 B1	
(e)	$-1 \leqslant f(x) \leqslant 1$	1	
(f)	Correct sketch of parabola shape from approximately $y = -1$ 5.48 or 5.477…	B1 B1	

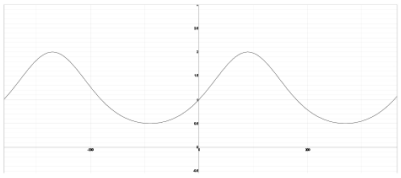
57. 0607_s16_ms_42 Q: 8

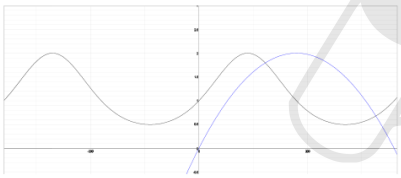
Question	Answer	Mark	Part Marks
(a)	[a, b, c =] –2, 1, 2	1, 1, 1	In any order
	[d =] 0	1	
(b)	– 1	1	
(c)	– 1	1	
(d)	Parabola vertex downwards and vertex below x-axis	M1	
	Cuts given graph in 5 places	A1	

58. 0607_s16_ms_43 Q: 11

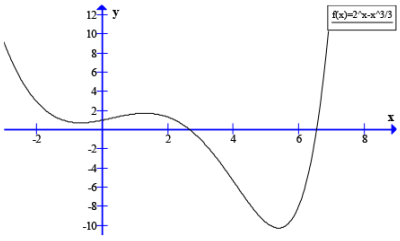
Question	Answer	Mark	Part Marks
(a)	Correct sketch	4	**B1** Correct graph for $x > 3$ **B1** Correct graph for $x < 1$ **B1** Correct graph for $1 < x < 3$ **B1** Approximately correct intercepts
(b)	$x = 1$ $x = 3$ $y = 3$	1 1 1	
(c)	(2, 2)	1	
(d)	1.38, 2, 3.62	3	**B1** for each

59. 0607_w16_ms_41 Q: 3

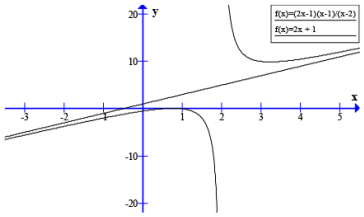
Qu.	Answer	Mark	Part Marks
(a)	Correct sketch 	3	**B1** for shape including 2 minimum points and 2 maximum points **B1** for all above x-axis
(b)	$0.5 \leqslant f(x) \leqslant 2$	2	Allow written separately or in words **B1** for each **SC1** for $0.5 \leqslant x \leqslant 2$

Qu.	Answer	Mark	Part Marks
(c) (i)	1	1	
(ii)	2	1	
(d) (i)	–90, 270, 630, 990	2	**B1** for –90 and 270 with no others from –360 to 360
(ii)	$360n - 450$ oe	2FT	**FT** only if clear linear sequence **B1FT** for $360n + k$ or $kn - 450$
(e) (i)	Correct sketch 	2	**B1** for parabola vertex upwards
(ii)	122.4 or 122 or 122.4… 326.2 or 326 or 326.2…	1 1	

60. 0607_w16_ms_42 Q: 14

Question	Answer	Mark	Part Marks
(a)	Fully correct curve  	**4**	**B1** for correct graph for $x < 0$, minimum point seen above x-axis **B1** for correct graph for $0 < x < 2$, maximum point seen higher than minimum point **B1** for minimum point seen below x-axis, $2 < x < 8$ If 0 or 1 scored, **SC2** instead for 'correct curve' except stationary point of inflexion instead of LH minimum and maximum
(b)	0.729 or 0.7287... –10.3 or –10.26...	**2**	**B1** for each
(c)	(1.31 or 1.311 to 1.312, 1.73[0])	**2**	**B1** for each co-ordinate
(d)	–2.82, 0.364, 4.23, 5.76 or –2.824 to –2.823 0.3643 to 0.3644 4.228 to 4.229 5.758…	**4**	**B1** for each If 0 scored **SC2** for –2.8, 0.36, 4.2, 5.8 or **SC1** for three of these.

61. 0607_w16_ms_43 Q: 10

Question	Answer	Mark	Part Marks
(a) (i)	$(2x - 1)(x - 1)$	**2**	**SC1** for $(2x + a)(x + b)$ where $ab = 1$ and $a + 2b = -3$
(ii)	$\frac{(2x+1)(x-2)+3}{x-2}$ oe	**M1**	
	$\frac{2x^2-4x+x-2+3}{x-2}$	**A1**	Allow $-3x$ for $-4x + x$
	$\frac{2x^2-3x+1}{x-2}$	**A1**	
(b) (i)	Correct sketch  	**2**	With no undue overlap at $x = 2$ or serious curving back **B1** for either branch correct

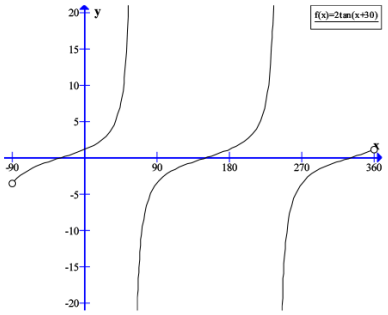
Question	Answer	Mark	Part Marks
(ii)	Correct line	**2**	Not intersecting either branch **B1** for line with positive gradient and positive y intercept
(iii)	$y = 2x + 1$ $x = 2$	**1** **1**	
(iv)	0.5 1	**1** **1**	

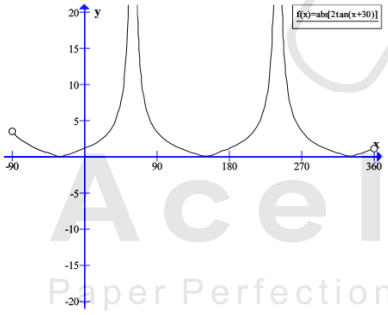
62. 0607_s15_ms_41 Q: 15

Qu.	Answer	Mark	Part Marks
(a) (i)	$y = 1$ $x = 1$ $x = 3$	**1** **1** **1**	
(ii)	(1.73, –13.9) or (1.732... , –13.93 to –13.92)	**2**	**B1** for each
(iii)	(–1.73, –0.07 18) or (–1.732... , –0.07180 to –0.07179...)	**2**	**B1** for each

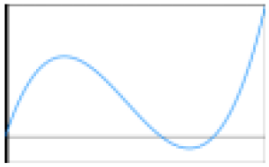
Qu.	Answer	Mark	Part Marks
(b) (i)	$-13.9 < k < -0.0718$	**2FT**	**FT** y coordinates from **(ii)** and **(iii)** **B1** for one inequality correct or **SC1** for $-13.9 \leqslant k \leqslant -0.0718$ or for $-13.9 < x < -0.0718$
(ii)	–13.9, –0.0718	**1FT**	**FT** y coordinates from **(a)(ii)** and **(a)(iii)**
(c)	$x < -3$ $-1 < x < 1$ $x > 3$	**1** **1** **1**	Not f(x)

63. 0607_s15_ms_42 Q: 10

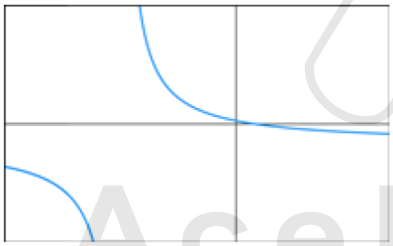
Qu.	Answer	Mark	Part Marks
(a)	Correct curve with no overlaps at 60 and 240, x intercepts at approximately –30, 150, 330 	3	**B2** for 'correct' but with overlaps and/or inaccurate intercepts **B1** for 1 branch correct
(b)	38.2 or 38.19 to 38.2 218 or 218.1 to 218.2	1 1	
(c)	$x = 60$ $x = 240$	1 1	

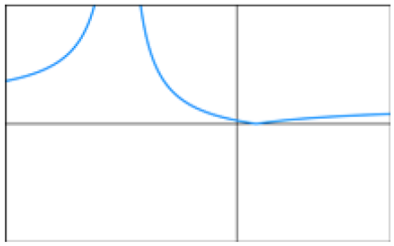
Qu.	Answer	Mark	Part Marks
(d)	*their* **(a)** with negative y parts reflected in x-axis 	2FT	**B1FT** for 1 branch correct

64. 0607_s15_ms_43 Q: 5

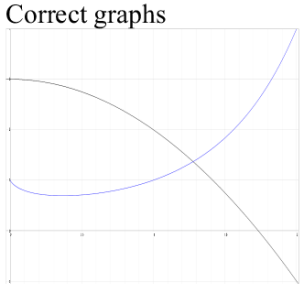
Qu.	Answer	Mark	Part Marks
(a)	$x(40 - 2x)(30 - 2x)$ $1200 - 80x - 60x + 4x^2$	2 1	or **B1** for $40 - 2x$ or $30 - 2x$ indep
(b)		2	**B1** for any cubic curve ($+x^3$) with max & min
(c)	2.19 or 2.192... 10 22.8 or 22.80 to 22.81	1 1 1	
(d)	22.8 would produce negative width/length	1	oe
(e)	3030 or 3032 to 3032.3... 28.7 or 28.68 to 28.69 or 18.7 or 18.68 to 18.69	1 1	

65. 0607_s15_ms_43 Q: 11

Qu.	Answer	Mark	Part Marks
(a)		3	**M1** Basic shape **A1** RH branch cuts both +ve axes **A1** asymptotes approximately right with no overlap
(b)	$x = -3$ $y = -2$	1 1	
(c)	$-2 < y \leq \frac{1}{3}$	2	May be separate, **B1** for either

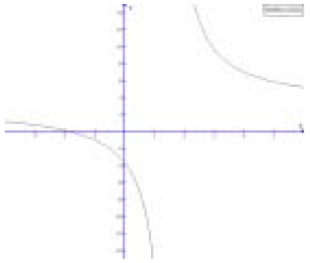
Qu.	Answer	Mark	Part Marks
(d)		2	Correct shape **B1** for reflection of any part of **(a)** in x-axis
(e)	–4.75 –2.125 or –2.12 or –2.13	1 1	

66. 0607_w15_ms_41 Q: 8

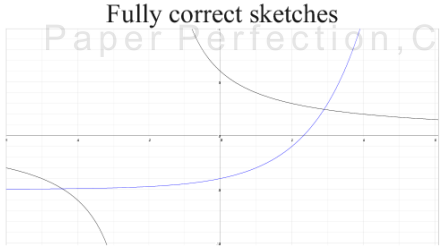
Question	Answer	Mark	Part Marks
(a)	Correct graphs 	2 2	**B1** for inaccurate parabola **B1** for correct shape but inaccurate
(b)	1.28 or 1.277 to 1.278	1	

Question	Answer	Mark	Part Marks
(c)	1.73 or 1.732…	1	
(d) (i)	0.368 or 0.3678 to 0.3679 0.692 or 0.6922…	1 1	 **SC1** for (0.37, 0.69)
(ii)	$0.692 \leqslant y \leqslant 4$ oe	2FT	**B1FT** for $0.692 \leqslant y$ oe or **B1** for $y \leqslant 4$ oe or **B1FT** for 0.692 and 4 **SC1FT** for $0.692 < y < 4$
(e) (i)	0.794 or 0.7943… 0.955 or 0.9549 to 0.9550 0.993 or 0.9931…	1 1 1	
(ii)	1	1	

67. 0607_w15_ms_42 Q: 7

Question	Answer	Mark	Part Marks
(a) (i)	Correct graph 	2	**M1** for graph in 2 sections, with each section approximately correct.
(ii)	$x = 1.5$ oe $y = 3$	1 1	
(iii)	(0, –3.67) or (0, –3.667 to –3.666) or $\left(0, -\frac{11}{3}\right)$	1	
	(–1.83, 0) or (–1.833…, 0) or $\left(-\frac{11}{6}, 0\right)$	1	
(b)	$1.5 < x < 5.5$ oe and	3	**B2** for $1.5 \leqslant x \leqslant 5.5$ oe or **B1** for 1.5 and 5.5 seen or for $x \leqslant 5.5$ or $1.5 \leqslant x$
	$x < -1$	1	Condone $\leqslant$ Ignore inclusion of –4 or 6 throughout

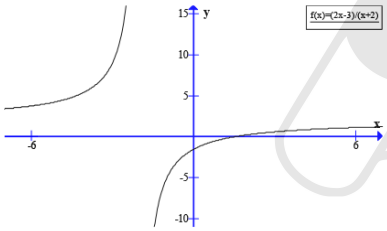
68. 0607_w15_ms_43 Q: 12

Question	Answer	Mark	Part Marks
(a)	Fully correct sketches 	2	**B1** for rectangular hyperbola with correct orientation but inaccurate
		2	Correct curve crossing positive x-axis and negative y-axis **B1** for exponential curve with correct orientation but inaccurate
(b) (i)	$x = -2$ $y = 0$	1 1	
(ii)	$y = -5$	1	
(c)	$x > 2.9[0]$ or 2.897…	2	**B1** for 2.9[0] or 2.897… seen

69. 0607_s20_ms_42 Q: 9

Question	Answer	Marks	Partial Marks
(a)(i)	–2	**1**	
(a)(ii)	3	**2**	**M1** for $f\left(\frac{1}{3}\right)$ oe
(b)	$-\frac{2}{3}$ oe	**2**	**M1** for $g\left(-\frac{1}{2}\right)$ oe
(c)	$\frac{1}{3}$ and $\frac{7}{3}$	**3**	**M2** for $4-3x=\pm 7$ or **M1** for $f(x)=\pm 3$ If 0 scored **B1** for each answer
(d)	$3(3x-5)(x-1)$	**3**	**B2** for $9x^2-12x-12x+15$ or **M1** for $(4-3x)^2-1$

70. 0607_w18_ms_42 Q: 12

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	**3**	**B1** for correct left hand branch without serious curl back **B2** for correct right-hand branch or **B1** for correct shape right-hand branch but with clear intercepts but serious overlap or curl back
(b)	$x=-2$ oe $y=2$ oe	**2**	**B1** for each
(c)(i)	–2.81 or –2.812 to –2.811 2.31 or 2.311 to 2.312	**2**	**B1** for each or for $2x^2+x-13=0$
(c)(ii)	$\frac{x+16}{x+2}$	**3**	**M2** for $\frac{5(x+2)-2(2x-3)}{x+2}$ or **M1** for $5-2\left(\frac{2x-3}{x+2}\right)$ oe

71. 0607_w17_ms_43 Q: 1

Question	Answer	Marks	Partial Marks
(a)(i)	10	1	
(a)(ii)	0.1	1	
(b)	5	2	**M1** for g(5) = 0.2 oe
(c)	0 and –4 nfww	3	**M1** for h(x) = 4 or $3(x+2)^2 - 2[=10]$ **B1** for $(x+2)^2 = 4$ oe or $3x^2 + 12x = 0$ oe
(d)	$\frac{1}{9x^2}$ or $\frac{1}{(3x)^2}$ oe final answer	2	**M1** for $(3x - 2 + 2)^2$

72. 0607_w17_ms_43 Q: 9

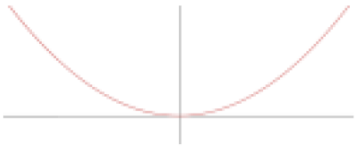
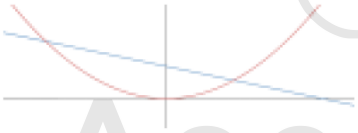
Question	Answer	Marks	Partial Marks
(a)(i)	Correct graph	2	**B1** for correct shape with a max

Question	Answer	Marks	Partial Marks
(a)(ii)	(0, 10) (3.7[0], 0) or (3.701 to 3.702, 0)	2	**B1** for each
(a)(iii)	3.54 or 3.541…	1	
(b)(i)	Correct graph	2	**B1** for correct shape with a min
(b)(ii)	(1.47, 0.488) or (1.473 to 1.474, 0.4877…)	2	**B1** for each
(b)(iii)	0.0982 or 0.09819 to 0.09820 and 2.98 or 2.975 or 2.976	2	**B1** for each
(b)(iv)	1.1[0] or 1.098… 3.98 or 3.975 to 3.976	2	**FT** *their* (iii) + 1 **B1** for each

73. 0607_m21_ms_42 Q: 11

Question	Answer	Marks	Partial Marks
(a)	4	**1**	
(b)	28	**2**	**B1** for f(3^2) seen or **M1** for $3 \times 3^{x+1}$ oe
(c)	$-\frac{1}{2}$ oe	**2**	**M1** for $3r + 1 = r$
(d)	$\frac{4}{3}$ oe , -2	**3**	**M1** for $(3x + 1)^2 - 5$ **M1** for $(3x + 1) = \pm 5$ or $[3](x + 2)(3x - 4) = 0$ oe or correct substitution in formula for $3x^2 + 2x - 8$ or $9x^2 + 6x - 24$ or correct and suitable sketch
(e)	$\log_3 x$ or $\frac{\log x}{\log 3}$ final answer	**2**	**M1** for $\log y = \log 3^x$ oe or correct answer seen or $x = 3^y$ or $\log_3 y = x$

74. 0607_s21_ms_41 Q: 5

Question	Answer	Marks	Partial Marks
(a)(i)	–5	1	
(a)(ii)	25	2	**M1** for g(–2) = 5 or $(3-x)^2$ soi
(b)	4	2	**M1** for $2x - 1 = 7$
(c)	$5 - 2x$ oe Final answer	1	
(d)	$\frac{3}{7}$ oe	3	**B2** for $6x-3+x-2x^2+2x^2$ [=0] or better or **B1** for $6x-3+x-2x^2$ or **M1** for $(2x-1)(3-x)+2x^2$ [=0]
(e)	$3-x$ Final answer	2	**M1** for $x = 3 - y$ or $y + x = 3$
(f)(i)	Correct sketch 	2	**B1** for any quadratic graph
(f)(ii)	$x = 0$ cao	1	
(f)(iii)	Correct sketch 	1	
(f)(iv)	–2.3[0] < x < 1.3[0] or –2.303 to –2.302 < x < 1.302 to 1.303	2	For x, do not allow f(x) or y for full marks **B1** for either inequality or for 1.3[0] and –2.3[0] y range included scores 0

75. 0607_s21_ms_42 Q: 12

Question	Answer	Marks	Partial Marks
(a)	–10	1	
(b)	$\frac{1}{4}$ oe	3	**M2** for $5 = 8 - 12x$ oe or **M1** for $\frac{5}{2-3x} = 4$

Question	Answer	Marks	Partial Marks
(c)	$\frac{2-x}{3}$ oe	2	**M1** for $3x + y = 2$ or $x = 2 - 3y$ or $\frac{y}{3} = \frac{2}{3} - x$ or better
(d)	$\frac{5}{-4+9x}$ oe final answer	2	**M1** for $\frac{5}{2-3(2-3x)}$
(e)	$\frac{9x^2-12x-1}{2-3x}$ oe final answer	3	**M1** for $\frac{(2-3x)(2-3x)-5}{2-3x}$ **B1** for $4 - 6x - 6x + 9x^2$

76. 0607_w21_ms_41 Q: 10

Question	Answer	Marks	Partial Marks
(a)	10	2	**B1** for g(1) = 4 soi
(b)	8, –2	2	**B1** for each
(c)	2	2	**B1** for $3x - 2 = 4$ or $\frac{x+2}{3}$
(d)	x cao	1	

77. 0607_s20_ms_43 Q: 12

Question	Answer	Marks	Partial Marks
(a)	11	1	
(b)	1.4 oe	2	**M1** for $2x + 3x = 5 - 3 + 5$
(c)	$\frac{5-x}{3}$ oe	2	**M1** for $x = 5 - 3y$ or $y - 5 = -3x$ oe or $\frac{y}{3} = \frac{5}{3} - x$ oe
(d)	$13 - 6x$	2	**M1** for $2(5 - 3x) + 3$
(e)	$\frac{19}{(2x+3)(5-3x)}$ final answer	3	**M1** for $2(5 - 3x) + 3(2x + 3)$ **M1** for common denominator $(2x + 3)(5 - 3x)$

78. 0607_w20_ms_42 Q: 11

Question	Answer	Marks	Partial Marks
(a)	$-\frac{2}{5}$ oe	2	**M1** for $5 - 7 = 2x + 3x$ oe or better
(b)	$17 - 6x$ Final answer	2	**M1** for $2(5 - 3x) + 7$ seen
(c)(i)	$12 - x^2$ Final answer	2	**M1** for $5 - 3x^2 + 2x^2 + 7$
(c)(ii)	$x^2 - 24x + 144$ Final answer	3	**M1** for $(5 - 3x + 2x + 7)^2$ oe **B1** for three terms of $144 - 12x - 12x + x^2$ correct
(d)	$\frac{5-x}{3}$ oe Final answer	2	**M1** for $x = 5 - 3y$ or $y + 3x = 5$ or $y - 5 = -3x$ or $\frac{y}{3} = \frac{5}{3} - x$
(e)	$\frac{13x-1}{(5-3x)(2x+7)}$ Final answer	3	**M1** for $2(2x + 7) - 3(5 - 3x)$ or better seen **M1** for common denominator $(5 - 3x)(2x + 7)$

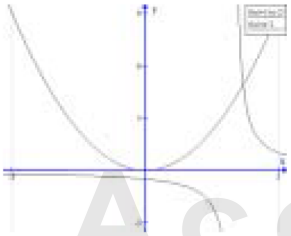
79. 0607_w20_ms_43 Q: 11

Question	Answer	Marks	Partial Marks
(a)	1	2	**B1** for 3^2 or 2^3
(b)	–2	1	
(c)	$\frac{x^4-1}{x^3}$ final answer	2	**M1** for $x - \frac{1}{x^3}$
(d)	$\sqrt[3]{x}$ oe final answer	1	

80. 0607_s19_ms_41 Q: 10

Question	Answer	Marks	Partial Marks
(a)(i)	11	**1**	
(a)(ii)	–23	**2**	**M1** for $5 - 2(3 \times 4 + 2)$ soi or $5 - 2(3x + 2)$
(a)(iii)	$\frac{1}{8}$ oe	**3**	**M1** for $5 - 2x = 2(3x + 2)$ oe **M1FT** for $5 - 4 = 6x + 2x$ or better
(a)(iv)	$\frac{5-x}{2}$ oe final answer	**2**	**M1** for $2x + y = 5$ or better or $x = 5 - 2y$ or $\frac{y}{2} = \frac{5}{2} - x$
(a)(v)	$17 - 6x$ oe final answer	**2**	**M1** for $3(5 - 2x) + 2$
(a)(vi)	$\frac{5x+16}{(5-2x)(3x+2)}$ or $\frac{5x+16}{10+11x-6x^2}$ final answer	**3**	**M1** for common denominator $(5 - 2x)(3x + 2)$ oe **M1** for $3(3x + 2) + 2(5 - 2x)$ oe
(b)	x	**1**	

81. 0607_w19_ms_42 Q: 2

Question	Answer	Marks	Partial Marks
(a)	0.25 oe	1	
(b)	1.5	2	**M1** for $1 = -2(x-2)$ or $\frac{1}{-2} = x-2$
(c)	$(x+2)^2$	1	
(d)	–0.5 or $-\frac{1}{2}$	4	**B1** for x^2+4x+4 **M2** for $4x+4=2$ or **M1** for $their(c) = x^2+2$ or **M2** for correct sketch or **M1** for any U-shaped parabola
(e)	$\frac{1}{x}+2$ oe final answer	3	**M2** for $x=\frac{1}{y}+2$ or $xy=1+2y$ or $y-2=\frac{1}{x}$ or **M1** for $x-2=\frac{1}{y}$ or $y(x-2)=1$ or $x=\frac{1}{y-2}$
(f)(i)	Correct sketches 	3	**B1** for correct quadratic shape through origin **B2** for correct rectangular hyperbola shape or **B1** for one branch

Question	Answer	Marks	Partial Marks
(f)(ii)	$x=0$	1	
(f)(iii)	$2 < x < 2.21$ or 2.205 to 2.206	2	**B1** for each part or 2 and 2.21 or 2.205 to 2.206 seen

82. 0607_w19_ms_43 Q: 13

Question	Answer	Marks	Partial Marks
(a)	9	1	
(b)	–6	2	**M1** for $f(x) = -7$ or for $f^{-1}(x) = \frac{x-5}{2}$
(c)	–21	2	**B1** for 11 seen or **M1** for $1 - 2(2x + 5)$
(d)	$7 - 4x$	2	**M1** for $2(1 - 2x) + 5$
(e)	$\frac{1-x}{2}$ oe	2	**M1** for $2x = 1 - y$ or $x = 1 - 2y$ or $\frac{y}{2} = \frac{1}{2} - x$
(f)	$\frac{4x+13}{2x+5}$ final answer	2	**M1** for $\frac{2(2x + 5) + 3}{2x + 5}$

83. 0607_s18_ms_41 Q: 11

Question	Answer	Marks	Partial Marks
(a)	5	1	
(b)	0.1oe , 1, 10, 100	2	**B1** for 3 correct or all correct seen and spoilt.
(c)	6.5 oe	2	**M1** for $2x - 1 = 12$
(d)	$2x - 2$ or $2(x - 1)$	3	**B2** for correct unsimplified answer OR **M1** for substituting $x - 2$ for x **M1** for adding 3 to a function in x oe OR **M1** for $y = 2x + c$ ($c \neq -1$) leading to answer with gradient 2 **M1** for substituting coords of valid point into $y = 2x + c$
(e)	$\log x$	2	**M1** for $\log y = x$ or $x = 10^y$
(f)	23, 113	3	**B2** for 23 or **B1** for [g(x) =] 45 soi

84. 0607_s18_ms_42 Q: 11

Question	Answer	Marks	Partial Marks
(a)(i)	–1	1	
(a)(ii)	4	2	**M1** for $2x - 7 = 1$ or better
(b)	$\frac{x+7}{2}$ oe	2	**M1** for $y + 7 = 2x$ or $\frac{y}{2} = x - \frac{7}{2}$ or $x = 2y - 7$ Allow f(x) for y

Question	Answer	Marks	Partial Marks
(c)(i)	$2\sqrt{x} - 7$ final answer	1	Allow $x^{\frac{1}{2}}$ for $\sqrt{x}$
(c)(ii)	36	3	**M2 for** $\sqrt{x} = \frac{5+7}{2}$ or better e.g. $\sqrt{x} = 6$ or **M1** for $2\sqrt{x} - 7 = 5$ or *their* **(c)(i)** = 5
(d)(i)	$\frac{1}{\sqrt{2x-7}}$ oe final answer	2	**M1** for $\sqrt{2x-7}$ If 0 scored **SC1** for answer $\frac{1}{\textit{their}\textbf{(c)(i)}}$
(d)(ii)	$x > 3.5$	2	**M1** for $2x - 7 > 0$

85. 0607_s18_ms_43 Q: 12

Question	Answer	Marks	Partial Marks
(a)	$-\frac{3}{4}$ or – 0.75	1	
(b)	$\frac{4-x}{3}$ oe final answer	2	**M1** for $x = 4 - 3y$ or $y + 3x = 4$ or $y - 4 = -3x$ or $\frac{y}{3} = \frac{4}{3} - x$
(c)	–17	2	**B1** for [f(3)] = 7 or **M1** for $4 - 3(2x + 1)$ soi

Question	Answer	Marks	Partial Marks
(d)	$9x - 8$ final answer	2	**M1** for $4 - 3(4 - 3x)$
(e)	3	2	**M1** for $2^x - 1 = 7$ or $\log_2(x + 1)$ oe
(f)	$\frac{5 - x}{(2x + 1)(4 - 3x)}$ oe final answer	3	**M1** for $4 - 3x + 2x + 1$ **M1** for common denominator $(2x + 1)(4 - 3x)$

86. 0607_w18_ms_43 Q: 13

Question	Answer	Marks	Partial Marks
(a)	4	**1**	
(b)(i)	$1 - 3x$ oe	**2**	**M1** for $3(1-x) - 2$
(b)(ii)	$5x$	**3**	**B2** for $-3x^2 + 3x + 2x - 2$ or **M1** for $(3x-2)(1-x) + 3x^2 + 2$
(c)	$1 - x$ oe	**1**	
(d)(i)	$\frac{4}{3}$ oe	**2**	**M1** for $3x - 2 = 2$
(d)(ii)	± 1, $\pm\sqrt{7}$ nfww	**3**	**M1** for $x^2 - 4 = \pm 3$ oe (implied by 1 and $\sqrt{7}$) **A1 dep** on **M1** for two correct answers If 0 scored, **SC1** for $\pm\sqrt{7}$ or for ± 1

87. 0607_s17_ms_43 Q: 8

Question	Answer	Marks	Part Marks
(a)	10	**1**	
(b)	4	**2**	**M1** for [h(1) =] $\frac{1}{2}$ or for [gh(x) =] $3 + 2\left(\frac{1}{x+1}\right)$
(c)	$5x^2 + 12x + 11$	**3**	**M1** for $(3+2x)^2 + 1 + x^2 + 1$ **B1** for $9 + 6x + 6x + 4x^2$ or better for $(3+2x)^2$
(d)	$\frac{1}{x} - 1$ or $\frac{1-x}{x}$ oe final answer	**3**	**M1** correct first step **M1** correct second step
(e)(i)	-1	**2**	**M1** for $3 + 2x = 1$
(e)(ii)	5	**1**	

88. 0607_w17_ms_41 Q: 12

Question	Answer	Marks	Partial Marks
(a)	-2	2	**M1** for $-3x = 11 - 5$ oe
(b)	$\frac{5-x}{3}$ oe final answer	2	**M1** for $3x = 5 - y$ or $x = 5 - 3y$ or $y - 5 = -3x$ or $\frac{y}{5} = \frac{5}{3} - x$ or better
(c)	$\frac{5}{3}$ oe $\quad -\frac{3}{2}$ oe final answers	2	**B1** for each

Question	Answer	Marks	Partial Marks
(d)(i)	x	1	
(d)(ii)	$11x - 7$	3	**M2** for $5 - 3(5 - 3x) + 2x + 3$ or **M1** for $5 - 3(5 - 3x)$
(d)(iii)	$\frac{26-8x}{(5-3x)(2x+3)}$ final answer	3	**M1** for $2(2x+3) + 4(5-3x)$ oe **M1** for common denominator $(5-3x)(2x+3)$

89. 0607_s16_ms_41 Q: 13

Question	Answer	Mark	Part Marks
(a) (i)	2.25 oe	2	**M1** for $1 = 2(5 - 2x)$ or $5 - 2x = \frac{1}{2}$ oe
(ii)	$-5 + 4x$ final answer	2	**B1** for $5 - 2(5 - 2x)$
(iii)	$\frac{5-x}{3}$ oe final answer	2	**M1** for $2x = 5 - y$ or $x = 5 - 2y$ or $\frac{y}{2} = \frac{5}{2} - x$
	$\frac{2}{3}$	1	

90. 0607_s16_ms_42 Q: 10

Question	Answer	Mark	Part Marks
(a)	31	2	**B1** for [f(7) =] 12 or **M1** for $2(x^2 - x - 30) + 7$
(b)	$\frac{x-7}{2}$ oe	2	**M1** for $y - 7 = 2x$ or $x = 2y + 7$ or $\frac{y}{2} = x + \frac{7}{2}$
(c)	$(2x+13)(2x+1)$ final answer	3	**B2** for $(2x+7+6)(2x+7-6)$ or for $4x^2 + 28x + 13$ or **M1** for $(2x+7)^2 - 36$
(d)	$\frac{x+5}{x+6}$ final answer nfww	4	**B2** for $(x - 6)(x + 5)$ or **SC1** for $(x+a)(x+b)$ where $ab = -30$ or $a + b = -1$ and **B1** for $(x + 6)(x - 6)$

91. 0607_w16_ms_41 Q: 11

Qu.	Answer	Mark	Part Marks
(a)	2	2	**B1** for [f(33) =] 100 or **M1** for $\log(3x+1)$
(b)	$\frac{1}{100}$ or [0].01	2	**M1** for g(x) = $3(-1) + 1$ oe
(c) (i)	$\frac{x-1}{3}$ oe	2	**M1** for $x = 3y + 1$ or $y - 1 = 3x$
(ii)	10^x	2	**M1** for $x = \log y$ or $10^y = x$

92. 0607_s15_ms_42 Q: 12

Qu.	Answer	Mark	Part Marks
(a)	4 nfww	2	**B1** for $\frac{6}{4+1}$ oe seen or **M1** for $5\left(\frac{6}{4x+1}\right)-2$
(b) (i)	$\frac{6}{20x-7}$ final answer	2	**M1** for $\frac{6}{4(5x-2)+1}$
(ii)	$\frac{x+2}{5}$ oe final answer	2	**M1** for $y+2=5x$ or $x=5y-2$ or $\frac{y}{5}=x-\frac{2}{5}$ or better
(c) (i)	$\frac{1}{x+1}$ final answer	3	**M2** for $\frac{5x-2}{(5x-2)(x+1)}$ oe or **M1** for $\frac{5x-2}{(5x+a)(x+b)}$ oe where $ab=-2$ or $a+5b=3$ or **SC1** for $(5x-2)(x+1)$ seen

Qu.	Answer	Mark	Part Marks
(ii)	$\frac{26x-13}{(4x+1)(5x-2)}$ oe final answer	3	**M1** for common denominator $(4x+1)(5x-2)$ soi **M1** for $6(5x-2)-(4x+1)$ oe

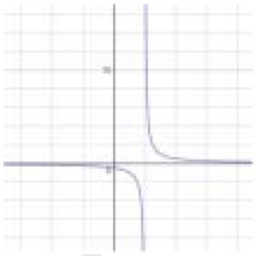
93. 0607_s15_ms_43 Q: 12

Qu.	Answer	Mark	Part Marks
(a) (i)	–2	1	
(ii)	–7	1FT	
(b) (i)	$6-6x$ oe	2	**B1** for $4-2(3x-1)$
(ii)	$\frac{4-x}{2}$ or $2-\frac{x}{2}$ oe	2	**B1** for $x=4-2y$ or $2x+y=4$
(iii)	$\frac{11-13x}{(3x-1)(4-2x)}$	3	**M2** for $\frac{2(4-2x)-3(3x-1)}{(3x-1)(4-2x)}$ or **B1** for $2(4-2x)-3(3x-1)$ or **SC2** for $\frac{5-13x}{(3x-1)(4-2x)}$ or **M1** for common denominator $(3x-1)(4-2x)$

94. 0607_m22_ms_42 Q: 8

Question	Answer	Marks	Partial Marks
(a)(i)	25	1	
(a)(ii)	–47	1	**FT** 3 – 2 × *their* 25
(b)	$\frac{1}{2}$ oe	2	**M1** for $2x + 1 = 3 - 2x$ or better
(c)	$7 - 4x$ final answer	2	**M1** for $2(3 - 2x) + 1$
(d)	$\frac{3-x}{2}$ oe final answer	2	**M1** for $y + 2x = 3$ or better or $\frac{y}{2} = \frac{3}{2} - x$ or $x = 3 - 2y$
(e)	99	2	**M1** for $\log(x+1) = 2(0.5) + 1$ or better
(f)	$10^x - 1$	2	**M1** for $10^y = x + 1$ or $x = \log(y + 1)$

95. 0607_m21_ms_42 Q: 7

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	3	**B2** for correct branches but joined or for 'correct' but with excessive overlap or 'curl back' **B1** for one correct branch

Question	Answer	Marks	Partial Marks
(b)	$y = 0$ $x = 2$	B2	**B1** for each
(c)	$-2.67 < x < 0.524$	B2	**B1** for $x > -2.67$ or $x < 0.524$ or $-2.7 < x < 0.52$
	$2 < x < 2.15$	B2	**B1** for either $x > 2$ or $x < 2.145\ldots$
			If B0, B0 scored, then **SC1** for 2 of the boundaries –2.67, 0.524, 2.15 seen

96. 0607_s21_ms_41 Q: 7

Question	Answer	Marks	Partial Marks
(a)	Correctly equating one set of coefficients	**M1**	or making x or y the subject of one equation
	Correct method to eliminate one variable	**M1**	May be intersection of two straight line graphs
	$[x =] 2$ $[y =] -3$	**A2**	**A1** for each If 0 scored for whole question, **SC1** for answers that satisfy one equation
(b)(i)	–5	**2**	**M1** for $3x = 4 - 19$ oe
(b)(ii)	4	**2**	**M1** for $5x - 3x = 15 - 7$ oe

Question	Answer	Marks	Partial Marks
(b)(iii)	–8	**2**	**M1** for $28 = -4(x + 1)$ oe or $\frac{28}{4} = -(x+1)$ oe
(c)	$\sqrt{\frac{p^3}{8q}}$ oe final answer	**3**	**M1** for $\log p^3$ or $\log x^2$ or better **M1** for correct use of $\log a + \log b = \log ab$ or $\log a - \log b = \log \frac{a}{b}$

97. 0607_s21_ms_43 Q: 11

Question	Answer	Marks	Partial Marks
(a)(i)	8	**1**	
(a)(ii)	29	**2**	**M1** for $g(3) = 9$ or $3(x^2) + 2$
(a)(iii)	8	**3**	**B1** for $h(g(3)) = 2^9$ or 512 **B1** for $g(h(3)) = 2^6$ or 64

Question	Answer	Marks	Partial Marks
(a)(iv)	$\frac{x-2}{3}$ oe final answer	2	**M1** for $x = 3y - 2$ or $y - 2 = 3x$ or $\frac{y}{3} = x + \frac{2}{3}$
(a)(v)	$\log_2 x$ or $\frac{\log x}{\log 2}$	2	**M1** for $x = 2^y$ or $x \log 2 = \log y$ oe
(b)(i)	$4\frac{1}{2}$ oe	2	**B1** for $[\log_3 81 =]4$ or $\left[\log_9\left(\frac{1}{3}\right) =\right] -\frac{1}{2}$
(b)(ii)	125	2	**B1** for $25 = b^{\frac{2}{3}}$ oe

98. 0607_w21_ms_42 Q: 3

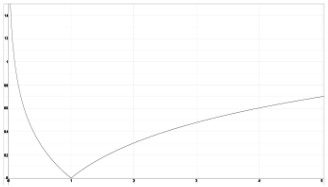
Question	Answer	Marks	Partial Marks
(a)(i)	1437	3	**B2** for 1440 or 1436.6 to 1436.7 or **M1** for $882 \times \left(1 + \frac{5}{100}\right)^{10}$ oe

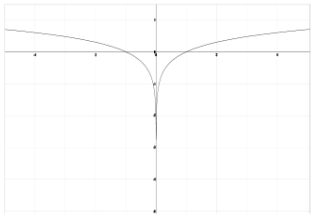
Question	Answer	Marks	Partial Marks
(a)(ii)	17 nfww	4	**B3** for 16.8 or 16.78... OR or **M3** $n \log\left(1 + \frac{5}{100}\right) = \log\left(\frac{2000}{882}\right)$ oe or correct trials reaching 16 and 17 or good sketch indicating value between 16 and 17 or **M2** for $\left(1 + \frac{5}{100}\right)^n = \frac{2000}{882}$ oe or at least 3 correct trials, $n > 10$ or suitable graph or **M1** for $882 \times \left(1 + \frac{5}{100}\right)^n = 2000$ oe soi by at least 2 trials with $n > 10$
(b)	7 or 6.999... nfww	3	**M2** for $\sqrt[10]{\frac{242}{500}}$ or **M1** for $500 \times (...)^{10} = 242$

99. 0607_w21_ms_42 Q: 8

Question	Answer	Marks	Partial Marks
(a)(i)(a)	7	1	
(a)(i)(b)	$\frac{1}{8}$ oe	1	**FT** *their* 7
(a)(ii)	$15x - 5$ or $5(3x - 1)$ final answer	2	**M1** for $3(5x - 1) - 2$
(a)(iii)	$-\frac{1}{2}$ oe	2	**M1** for $3x - 2 = 5x - 1$
(a)(iv)	$\frac{x+1}{5}$ oe final answer	2	**M1** for $x = 5y - 1$ or $y + 1 = 5x$ or $\frac{y}{5} = x - \frac{1}{5}$
(a)(v)	$\frac{3x+5}{(x+1)(x+2)}$ or $\frac{3x+5}{x^2+3x+2}$ final answer	4	**M1** for $\frac{2}{x+1} + \frac{1}{x+1+1}$ **FT** *their* fractions provided there are two fractions of the form $\frac{a}{b+c}$ to be collected **and** the denominators are different **M1** for $2(x + 2) + x + 1$ or better or **M1** for denominator $(x + 1)(x + 2)$
(b)(i)	$-\frac{3}{2}$ oe	1	
(b)(ii)	$\log_5 x$ or $\frac{\log x}{\log 5}$	2	**M1** for $x = 5^y$ or $\log y = x \log 5$ or $\log_5 y = x$

100. 0607_s20_ms_41 Q: 6

Question	Answer	Marks	Partial Marks
(a)(i)	Correct curve 	2	**B1** for correct curve from 0 to 1 or for correct curve from 1 to 5
(a)(ii)(a)	0.631 or 0.6309 to 0.6310 1.58 or 1.584 to 1.585	2	**B1** for each

Question	Answer	Marks	Partial Marks
(a)(ii)(b)	0.106 or 0.1063... 2.45 or 2.446...	4	**M2** for $y = 1 - \frac{x}{4}$ sketched or **M1** for sketch of line through (0, 1) approx or line with negative but inaccurate gradient **B1** for each answer
(b)(i)	Correct curve 	2	**B1** for one branch correct, not crossing y-axis
(b)(ii)	–1.58 or –1.585 to –1.584 1.58 or 1.584 to 1.585	2	**B1** for each
(c)	$x \geqslant 1$ oe	1	

101. 0607_s20_ms_41 Q: 10

Question	Answer	Marks	Partial Marks
(a)	253	2	**M1** for $2(5^x) + 3$ or f(125)
(b)	$\frac{x-3}{2}$ oe final answer	2	**M1** for $x = 2y + 3$ or for $y - 3 = 2x$ or for $\frac{y}{2} = x + \frac{3}{2}$
(c)	–2.5 oe	2	**M1** for $25 = 5^2$ and $\sqrt{5} = 5^{\frac{1}{2}}$ or better
(d)	$\log_5 x$ oe	2	**M1** for $x = 5^y$ or for $\log_5 y = x$ or for $x = \frac{\log y}{\log 5}$

Question	Answer	Marks	Partial Marks
(a)(i)	–2	**2**	**M1** for $2x = 1 - 5$ or $\frac{5}{2} + x = \frac{1}{2}$
(a)(ii)	2	**2**	**M1** for $-\frac{10}{x} = 1 - 6$ oe or $6x - 10 = x$
(a)(iii)	–13.5	**3**	**M1** for correct expansion $3 - 6x = 2 - 4x + 28$ **M1** for correct collection of *their* terms $3 - 30 = 6x - 4x$ **M1** for $\frac{\textit{their}(3-30)}{\textit{their}(6-4)}$
(b)(i)	$6x^2 + 3x - 7 = 0$	**B1**	
	Correct sketch OR $\frac{-3 \pm \sqrt{3^2 - 4 \times 6 \times -7}}{2 \times 6}$	**M2**	**M1** for any U-shaped parabola OR for $\frac{b}{2a}$ or $\sqrt{b^2 - 4ac}$ correct
	0.859, –1.359	**B1**	
(b)(ii)	0.927, –0.927	**2**	**FT** *their* (b)(i) **B1** for each
(c)	1.41 or 1.414… cao	**4**	**M3** for $5x^2 = 10$ or **M2** for $\log 5x^2$ [=1] or **M1** for $\log x^2 + \log 5$ [=1]

103. 0607_w20_ms_41 Q: 12

Question	Answer	Marks	Partial Marks
(a)	0.25 oe	3	**M2** for $8x=2$ or $-2=-8x$ or better or **M1** for $6x-2=-2x$ or $\frac{-2}{x}=-8$ oe OR **M2** for correct sketch that could lead to correct answer or **M1** for appropriate but incomplete sketch e.g. $6-\frac{2}{x}$
(b)	–2.8 oe	3	**M2** for $8x+2x=1-16-3-10$ oe or **M1** for $3+8x+10$ or $1-2x-16$
(c)	2	3	**M1** for $\log x^3$ or $\log 3^2$ or $\log 6^2$ or better **M1** for correct use of $\log p-\log q=\log\frac{p}{q}$ or $\log p+\log q=\log pq$
(d)	3.32 or 3.321 to 3.322	3	**B2** for $\frac{\log 10}{\log 2}$ or $\log_2 10$ or $\frac{1}{\log 2}$ or **M1** for $x\log 2=\log 10$ OR **M2** for correct sketch that could lead to correct answer or **M1** for appropriate but incomplete sketch e.g. $y=2^x$

104. 0607_s19_ms_42 Q: 12

Question	Answer	Marks	Partial Marks
(a)	10	1	
(b)	9.5 oe	2	**M1** for $10-\frac{1}{x}$ soi e.g. $10-\frac{1}{2}$
(c)	$x^2-20x+101$	3	**M1** for $(10-x)^2+1$ **B1** for $100-10x-10x+x^2$ oe
(d)	f(x) and h(x)	2	**B1** for each
(e)	$\frac{10-2x}{x(10-x)}$ oe	3	**M1** for common denominator $x(10-x)$ oe **B1** for $(10-x)-x$ oe seen
(f)(i)	5	1	
(f)(ii)	$3\sqrt{3}$ oe or $3^{\frac{3}{2}}$ or 5.2[0] or 5.196...	1	
(f)(iii)	3^x	2	**M1** for $x=\log_3 y$ or $x=3^y$

105. 0607_s19_ms_43 Q: 9

Question	Answer	Marks	Partial Marks
(a)(i)	27	1	
(a)(ii)	–5	2	**M1** for $5-25=7x-3x$ or better

Question	Answer	Marks	Partial Marks
(a)(iii)	1.05 or 1.054… –1.3[0] or –1.304…	**4**	**M3** for $\frac{-2\pm\sqrt{2^2-4\times8\times-11}}{2\times8}$ or correct sketch which would lead to solution. or **M2** for $\frac{b}{2a}$ correct or b^2-4ac correct or **M1** for $8x^2+2x-11$ or $-8x^2-2x+11$ or sketch of $8x^2$ or $11-2x$
(b)(i)	$x \leqslant -2$ oe	**2**	**M1** for $6-10 \geqslant 2x$ or $-2x \geqslant 10-6$ or $3-x \geqslant 5$ or better If 0 scored **SC1** for $x \geqslant -2$ or $x = -2$
(b)(ii)	$2 < x < 2\frac{1}{3}$ oe	**3**	**M2** for $x = 2$ and $x = \frac{7}{3}$ or correct sketch which would lead to solution. or **M1** for $1 > 3(x-2)$ or better or sketch of $y = \frac{1}{x-2}$ or **B1** for $x < 2\frac{1}{3}$ or for $x > 2$
(c)	Correctly equating one set of coefficients oe	**M1**	
	Correct method to eliminate one variable	**M1**	
	[x=] 4	**B1**	
	[y=] –3	**B1**	
			If 0 scored **SC1** for correct substitution into one of original equations and evaluation to find other variable.
(d)	$\frac{13}{16}$ or 0.8125	**3**	**M1** for $\log 2^4$ or better **M1** for correct use of $\log p - \log q = \log \frac{p}{q}$ or use of $\log p + \log q = \log pq$

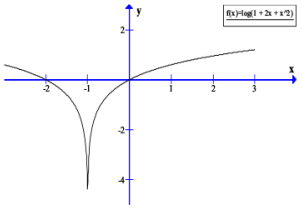
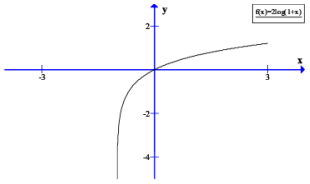
106. 0607_w19_ms_41 Q: 10

Question	Answer	Marks	Partial Marks
(a)(i)	–1	1	
(a)(ii)	2	1	
(b)	$\frac{1}{5}$ oe	2	**B1** for 5 or **M1** for $\frac{1}{2x+3}$ soi e.g. $\frac{1}{2(1)+3}$
(c)	–3	1	
(d)	4	1	
(e)	$4x + 9$	2	**M1** for $2(2x + 3) + 3$ oe
(f)	$4x^2 + 14x + 13$	3	**M1** for $(2x+3)^2 + 2x + 3 + 1$ oe **B1** for $[(2x+3)^2 =]\ 4x^2 + 12x + 9$
(g)	3^x	2	**M1** for $x = \log_3 y$ or for $x = 3^y$

107. 0607_w19_ms_43 Q: 11

Question	Answer	Marks	Partial Marks
(a)(i)	a^6 final answer	2	**B1** for a^9 or $a^2 \times a^4$ or $a^5 \times a$[1]
(a)(ii)	x	1	
(a)(iii)	$\frac{1}{2}x$ oe	1	
(b)	40	2	**M1** for one correct use of $a\log b = \log b^a$ or for correct use of $\log a - \log b = \log(a \div b)$

108. 0607_s16_ms_41 Q: 8

Question	Answer	Mark	Part Marks
(a) (i)	Correct sketch 	2	**B1** RH branch through (0, 0) ,with asymptote $x = a$ (–ve a) **B1** for LH branch symmetrical, with asymptote $x = a$ (–ve a)
(ii)	–2 0	1 1	
(iii)	$x = -1$	1	
(b) (i)	Correct sketch 	2	**B1** for correct shape
(ii)	Same right hand branch	1	
(iii)	e.g. $\log(1 + 2x + x^2) = 2\log(1 + x)$ No log of a negative number	1 1	Independent

109. 0607_w16_ms_42 Q: 13

Question	Answer	Mark	Part Marks
(a)	$\frac{p^3q^2}{6}$ final answer	3	**M1** for correct use of $a\log b$ **M1** for correct use of $\log a \pm \log b$
(b) (i)	1.29 or 1.292…	3	**M2** for $\frac{\log 6}{\log 4}$ or $\log_4 6$ or sketch of $y = 4^x$ and $y = 6$ oe or **M1** for $x\log 4 = \log 6$ or sketch of $y = 4^x$
(ii)	$6x^2 - 5x - 7 = 0$	B2	or **B1** for 3 terms correct in expansion $6x^2 - 9x + 4x - 6$
	$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 6 \times (-7)}}{2 \times 6}$	M1	**FT** *their* three term quadratic or for sketch of parabola with minimum point **Alternative** If sketch of parabola with minimum point and $y = 1$ and no three term quadratic seen, allow **B3**
	$x = 1.57$ or 1.574... $x = -0.741$[01...]	B2	**B1** for each

110. 0607_w15_ms_41 Q: 10

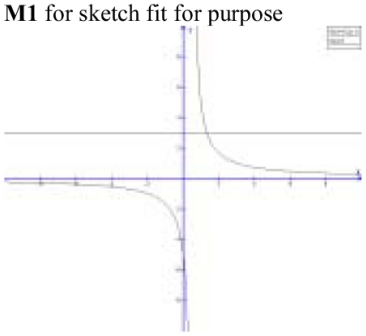
Question	Answer	Mark	Part Marks
(a)	5	2	**M1** for [h(9)=] 1 or for $2(\log(x+1))+3$
(b)	$2x + 2$ or $2(x + 1)$	2	**M1** for $2x + 3 – 1$
(c)	$\frac{3x+2}{(2x+3)(x-1)}$ oe final answer	3	**B1** for denominator $(2x + 3)(x – 1)$ oe **B1** for $x – 1 + 2x + 3$ as numerator
(d)	$-\frac{9}{10}$ oe	2	**M1** for $x+1=10^{-1}$ oe or appropriate sketch

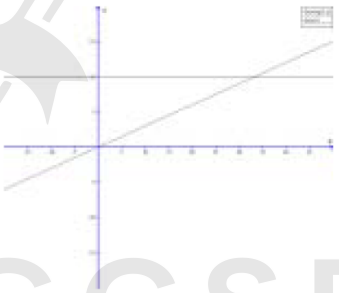
Question	Answer	Mark	Part Marks
(e)	$1\pm\sqrt{5}$ final answer cao	3	**B2** for $x-1=\sqrt{5}$ or $x-1=-\sqrt{5}$ or $\frac{2\pm\sqrt{20}}{2}$ oe or for –1.24 (or –1.236...) **and** 3.24 (or 3.236...) or **M1** for $(x-1)^2=5$ oe

111. 0607_w15_ms_42 Q: 2

Question	Answer	Mark	Part Marks
(a) (i)	40.5 oe	3	**M1** for correct use of $a\log b$ **M1** for correct use of $\log a \pm \log b$
(ii)	210, 330 with no extras in range	3	**B2** for 210 or 330 ignoring any extras from using 30. or **M2** for appropriate sketch or **M1** for $\sin x = –0.5$ **A1** for 30 or – 30 soi
(b)	$[x=]\frac{1}{1-a^2}$ oe	3	**M1** Correct squaring **M1** Correct multiplication **M1** Collection of terms **M1** Correct factorisation and division by *their* $(1-a^2)$ **If answer incorrect, maximum possible is M2**

112. 0607_w15_ms_42 Q: 15

Question	Answer	Mark	Part Marks
(a)	$x < 0.5$ and $x > \frac{4}{3}$	3	**M1** for sketch fit for purpose  **B1** for $x > \frac{4}{3}$ or for $x < 0.5$ or for 0.5 and $\frac{4}{3}$ soi

Question	Answer	Mark	Part Marks
(b)	$x > 33.2$ or 33.21 to 33.22	2	**M1** for appropriate sketch  or **M1** for $x \log 2 > 10$

113. 0607_w15_ms_43 Q: 8

Question	Answer	Mark	Part Marks
(a) (i)	$x > -7$ oe	3	**M2** for $2x - 5x < 15 + 6$ or better or **B1** for $2x - 6$ or $5x + 15$
(ii)	Line with empty circle at –7 and arrow to right	1FT	**Strict FT, must be from an inequality.**
(b)	Sketch of $y = (x + 3)^2 + (x + 1)^2 - 25$ oe	M2	**M1** for sketch of $(x + 3)^2 + (x + 1)^2$
	or	or	
	$2x^2 + 8x - 15 = 0$	B2	**B1** for $x^2 + 3x + 3x + 9$ or $x^2 + x + x + 1$ oe
	–5.39 **and** 1.39	B4	**B3** for –5.391... **and** 1.391... or **B2** for –5.39 **or** 1.39 or **B1** for –5.391... **or** 1.391... or **M1** for sketch of parabola or correct substitution in formula or reaching $2(x+2)^2 - 23$ oe
(c) (i)	Appropriate sketch which could lead to answer	M2	**M1** for correct sketch of log$x$ or other equation containing log$x$
	4.36 or 4.360…	B1	
(ii)	4.36 or 4.360… 5.76 or 5.760…	B1FT B1	
(d)	$\frac{x^2 - x + 2}{(x-1)(x+1)}$ oe final answer	3	**B1** for $x(x+1) - 2(x-1)$ oe seen **B1** for denominator $(x-1)(x+1)$ oe