Algebra and graphs – 2021 IGCSE 0580

1. Nov/2021/Paper_11/No.8

$$P = 2n - 3t$$

Find the value of n when $P = 9$ and $t = 8$.

$n =$ ..... [3]

2. Nov/2021/Paper_11/No.12

(a) 7, 13, 19, 25, …

Find the next term in this sequence.

..... [1]

(b) 30, 26, 22, 18, …

Write down the term to term rule for this sequence.

..... [1]

(c) −1, 1, 3, 5, …

Find the nth term for this sequence.

..... [2]

3. Nov/2021/Paper_11/No.14

(a) Factorise completely.

$$18x^2 - 12x$$

..... [2]

(b) Expand and simplify.

$$(x+5)(x-3)$$

..... [2]

4. Nov/2021/Paper_12/No.16

(a) Solve.

$7x + 18 = 4$

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

(b) $7^y \times 7^6 = 7^{18}$

Find the value of y.

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

5. Nov/2021/Paper_12/No.17

These are the first four terms of a sequence.

3 10 17 24

(a) Write down the next term.

..... [1]

(b) Write down the term to term rule.

..... [1]

(c) Find the nth term.

..... [2]

(d) Find the 40th term.

..... [2]

6. Nov/2021/Paper_13/No.7

$r = 2t + 3u$

Work out the value of t when $r = 18$ and $u = 4$.

$t =$ ..... [2]

7. Nov/2021/Paper_13/No.14

(a) These are the first four terms of a sequence.

17 23 29 35

Find the next term.

..... [1]

(b) These are the first four terms of a different sequence.

3 −1 −5 −9

(i) Find the next term in this sequence.

..... [1]

(ii) Find the nth term.

..... [2]

8. Nov/2021/Paper_13/No.23

(a) Simplify.

$$32g^{32} \div 4g^4$$

..... [2]

(b) Factorise completely.

$$10j - 15j^2$$

..... [2]

(c) Expand the brackets and simplify.

$$(x+7)(x+3)$$

..... [2]

9. Nov/2021/Paper_21/No.8

Solve the simultaneous equations.
You must show all your working.

$$4x - 2y = -13$$
$$-3x + 4y = 11$$

$x =$ .....

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

10. Nov/2021/Paper_21/No.13

Solve.

$$4 - 3x \geqslant \frac{6 - x}{5}$$

..... [3]

11. Nov/2021/Paper_21/No.16

Find the nth term of each sequence.

(a) 8, 15, 34, 71, 132, ...

..... [2]

(b) $\frac{2}{1}$, $\frac{3}{4}$, $\frac{4}{16}$, $\frac{5}{64}$, $\frac{6}{256}$, ...

..... [3]

12. Nov/2021/Paper_21/No.17

$$y = \frac{3x-2}{1-x}$$

Make x the subject of the formula.

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

13. Nov/2021/Paper_21/No.19

Write as a single fraction in its simplest form.

$$\frac{2}{x+3} - \frac{x+2}{7}$$

..... [3]

14. Nov/2021/Paper_21/No.22

(a) Simplify.

$$\frac{x^{\frac{2}{3}}}{x^{\frac{8}{3}}}$$

..... [1]

(b) $16 = 64^{k}$

Find the value of k.

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

(c) Solve.

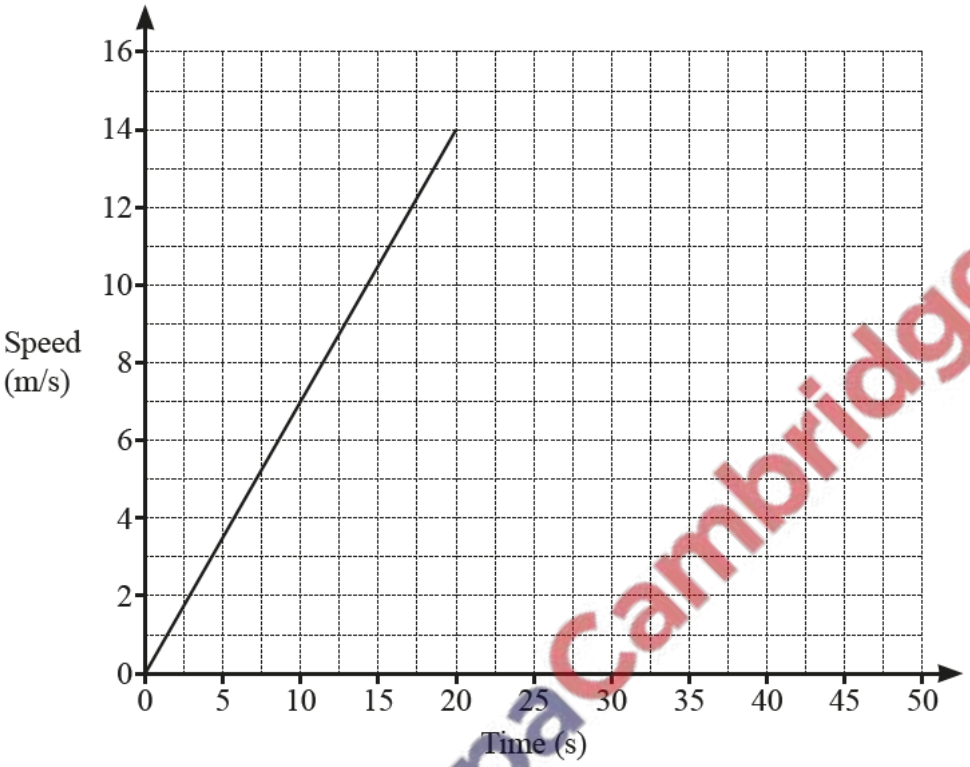
$$3^{3x} \times \left(\frac{1}{9}\right)^{4-3x} = 3$$

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

15. Nov/2021/Paper_22/No.11

A car starts its journey by accelerating from rest at a constant rate of 0.7 m/s^2 for 20 seconds, before reaching a constant speed of 14 m/s.
It then travels at 14 m/s for a distance of 210 m.
The car then decelerates at a constant rate of 1.4 m/s^2, before coming to a stop.

On the grid, complete the speed–time graph for the car's journey.



[3]

16. Nov/2021/Paper_22/No.12

The table shows the first five terms of sequences A, B and C.

	1st term	2nd term	3rd term	4th term	5th term	nth term
Sequence A	8	3	-2	-7	-12	
Sequence B	2	$\frac{3}{2}$	$\frac{4}{3}$	$\frac{5}{4}$	$\frac{6}{5}$	
Sequence C	$\frac{1}{2}$	1	2	4	8	

Complete the table to show the nth term of each sequence. [5]

17. Nov/2021/Paper_22/No.17

Solve.

$$(5x-3)(2x+7)=0$$

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

18. Nov/2021/Paper_22/No.18

Solve the simultaneous equations.
You must show all your working.

$$y = x^2 - 9x + 21$$
$$y = 2x - 3$$

$x =$ ..... $y =$ .....

$x =$ ..... $y =$ ..... [5]

19. Nov/2021/Paper_22/No.20

$$f(x) = 2^{x-3} \qquad g(x) = 2x - 1 \qquad h(x) = \frac{5}{x-4}$$

(a) Find ff(6).

..... [2]

(b) Find $g^{-1}g(x+21)$.

..... [1]

(c) Find x when $f(x) = h(84)$.

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

20. Nov/2021/Paper_22/No.21

Expand and simplify.

$$(x-3)^2(2x+5)$$

..... [3]

21. Nov/2021/Paper_22/No.23

Simplify.

$$\frac{3xy+36y-5x-60}{2x^2-288}$$

..... [4]

22. Nov/2021/Paper_23/No.7

Simplify.

$$32g^{32} \div 4g^{4}$$

..... [2]

23. Nov/2021/Paper_23/No.9

Write the recurring decimal $0.\dot{2}\dot{7}$ as a fraction.

..... [1]

24. Nov/2021/Paper_23/No.10

These are the first four terms of a sequence.

3 −1 −5 −9

(a) Find the next term in this sequence.

..... [1]

(b) Find the nth term.

..... [2]

25. Nov/2021/Paper_23/No.11

$$P = M(g^2 + h^2)$$

(a) Find the value of P when $M = 100$, $g = 3$ and $h = 4.5$.

$P =$ ..... [2]

(b) Rearrange the formula to write g in terms of P, M and h.

$g =$ ..... [3]

26. Nov/2021/Paper_23/No.21

Simplify fully.

$$(243y^{10})^{\frac{3}{5}}$$

..... [2]

27. Nov/2021/Paper_23/No.22

Solve the simultaneous equations.
You must show all your working.

$$y = x^2 - 3x - 13$$
$$y = x - 1$$

$x =$ ..... , $y =$ .....

$x =$ ..... , $y =$ ..... [5]

28. Nov/2021/Paper_23/No.25

Simplify.

$$\frac{3x^2 - 18x}{ax - 6a + 2cx - 12c}$$

..... [4]

29. Nov/2021/Paper_31/No.5

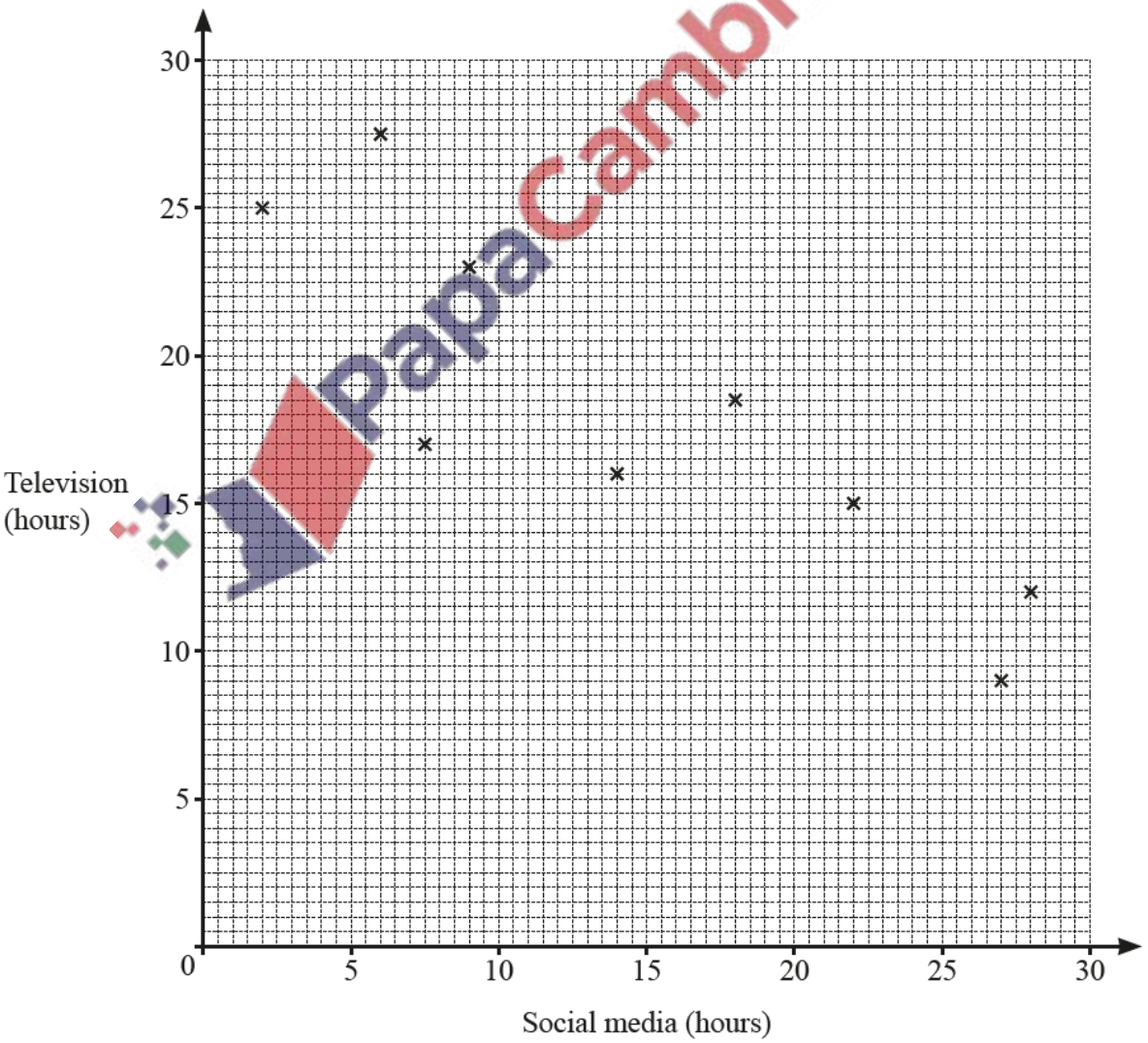
11 students record the time they spent on social media and watching television during one week. The table shows the time, in hours, for each student.

Social media (hours)	2	9	18	6	28	14	7.5	27	22	19.5	13
Television (hours)	25	23	18.5	27.5	12	16	17	9	15	11	20

(a) Find the range of the times spent on social media.

..... hours [1]

(b) **(i)** Complete the scatter diagram.
The first nine points have been plotted for you.



[1]

(ii) What type of correlation is shown on the scatter diagram?

..... [1]

(iii) Draw a line of best fit on the scatter diagram. [1]

(iv) Another student spent 21 hours watching television.

Use your line of best fit to estimate the number of hours this student spent on social media.

..... hours [1]

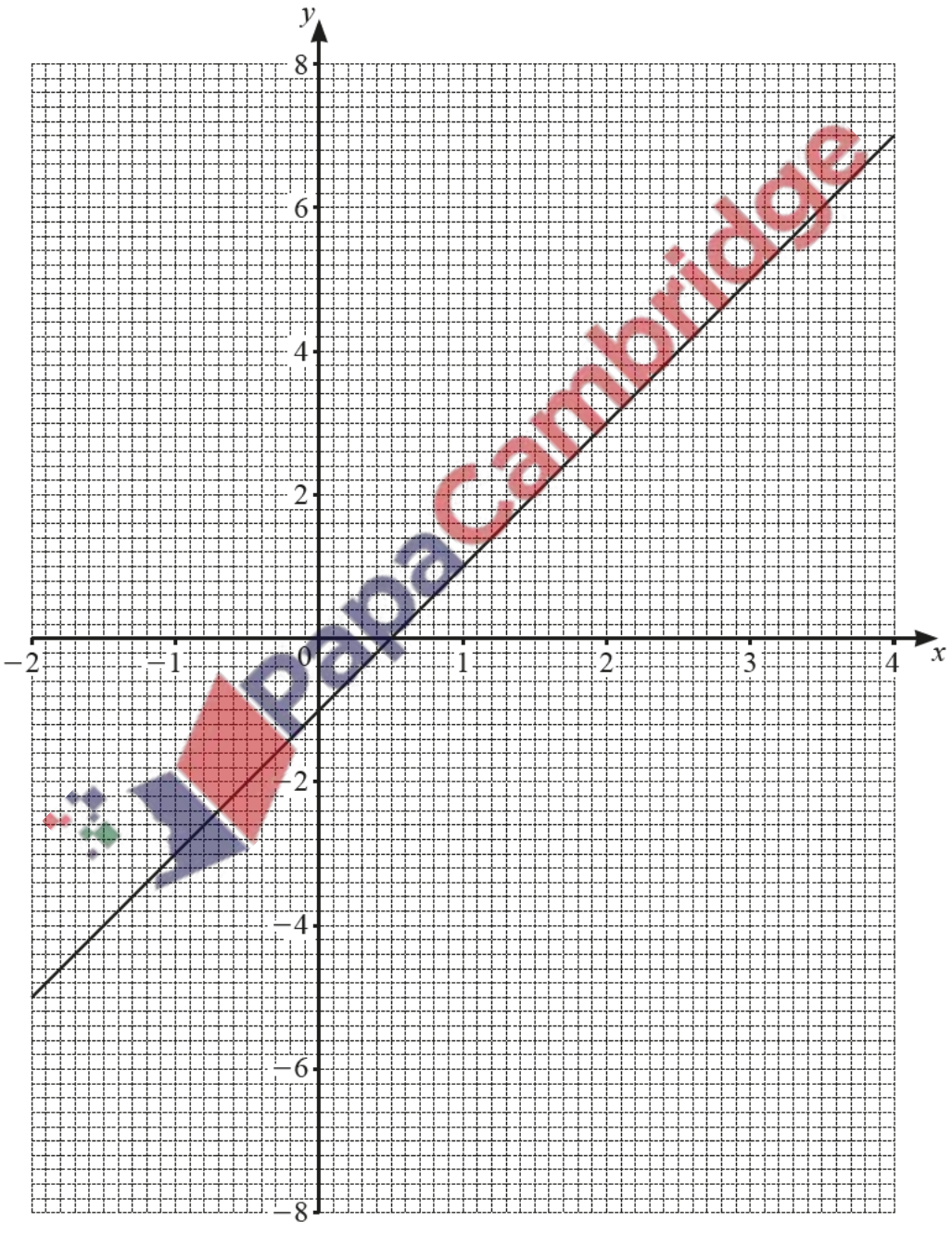
30. Nov/2021/Paper_31/No.10

(a) Complete the table of values for $y = 4 + 3x - x^2$.

x	-2	-1	0	1	2	3	4
y		0	4		6		0

[2]

(b) On the grid, draw the graph of $y = 4 + 3x - x^2$ for $-2 \leqslant x \leqslant 4$.



[4]

(c) The line $y = 2x - 1$ is drawn on the grid.

Use your graph to solve the equation $4 + 3x - x^2 = 2x - 1$.

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

31. Nov/2021/Paper_32/No.5

(a) Simplify.

$5a-3b+7a+2b$

..... [2]

(b) Find the value of $8x-3y$ when $x=5$ and $y=-2$.

..... [2]

(c) Solve.

$6x-3=2x+8$

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

(d) $P=6t-11$

Make t the subject of this formula.

$t =$ ..... [2]

(e) Solve the simultaneous equations.
You must show all your working.

$$3x - 4y = 30$$
$$2x + 5y = -3$$

$x =$ .....

$y =$ ..... [4]

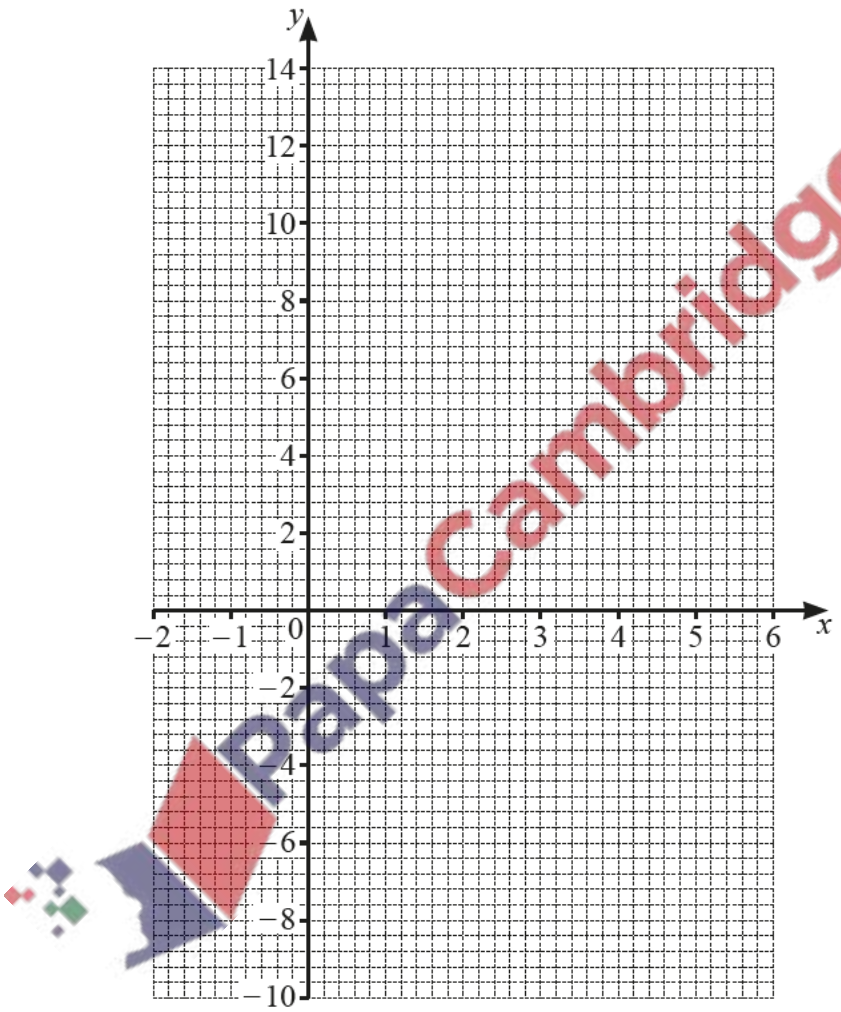
32. Nov/2021/Paper_32/No.10

(a) Complete the table of values for $y = x^2 - 5x - 2$.

x	-2	-1	0	1	2	3	4	5	6
y		4	-2		-8	-8		-2	4

[2]

(b) On the grid, draw the graph of $y = x^2 - 5x - 2$ for $-2 \leqslant x \leqslant 6$.



[4]

(c) On the grid, draw the line $y = 2$. [1]

(d) Use your graph to solve the equation $x^2 - 5x - 2 = 2$.

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

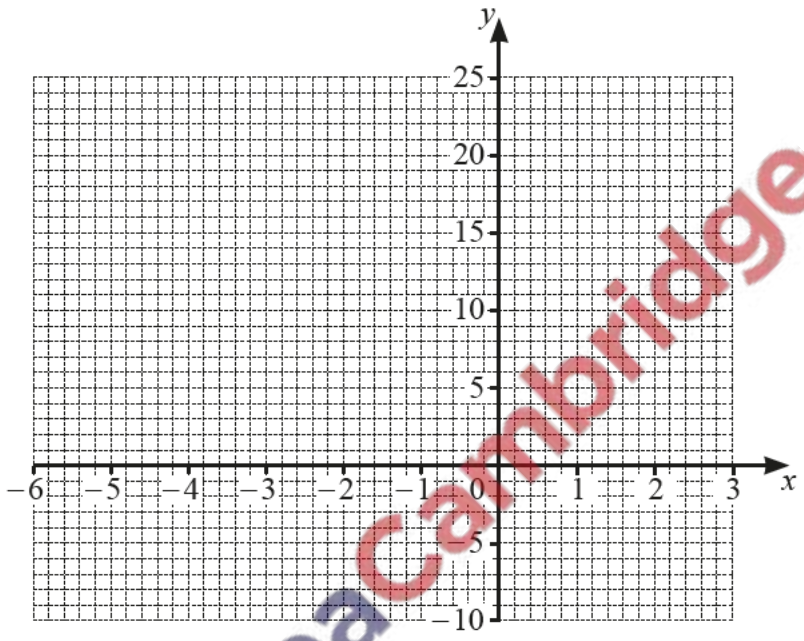
33. Nov/2021/Paper_33/No.8b

(b) (i) Complete the table of values for $y = x^2 + 4x$.

x	−6	−5	−4	−3	−2	−1	0	1	2	3
y	12	5	0	−3		−3	0	5	12	

[2]

(ii) On the grid, draw the graph of $y = x^2 + 4x$ for $-6 \leqslant x \leqslant 3$.



[4]

(iii) Use your graph to solve the equation $x^2 + 4x = 10$.

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

34. Nov/2021/Paper_33/No.9

(a) Simplify.

$3g+7g-4g$

..... [1]

(b) Solve.

$4x+5=27$

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

(c) $6^p \times 6^3 = 6^{17}$

Work out the value of p.

$p =$ ..... [1]

(d) Mia buys 4 calculators and 2 pens for $20.60 .
Heidi buys 5 calculators and 3 pens for $26.90 .

Write down a pair of simultaneous equations and solve them to find the cost of a calculator and the cost of a pen.

Calculator $ .....

Pen $ ..... [6]

35. Nov/2021/Paper_41/No.4

(a) Solve.

(i) $6(7-2x) = 3x-8$

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

(ii) $\frac{2x}{x-5} = \frac{2}{3}$

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

(b) Factorise completely.

(i) $2x^2 - 288y^2$

..... [3]

(ii) $5x^2 + 17x - 40$

..... [2]

(c) Solve $x^3 + 4x^2 - 17x = x^3 - 9$.
You must show all your working and give your answers correct to 2 decimal places.

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

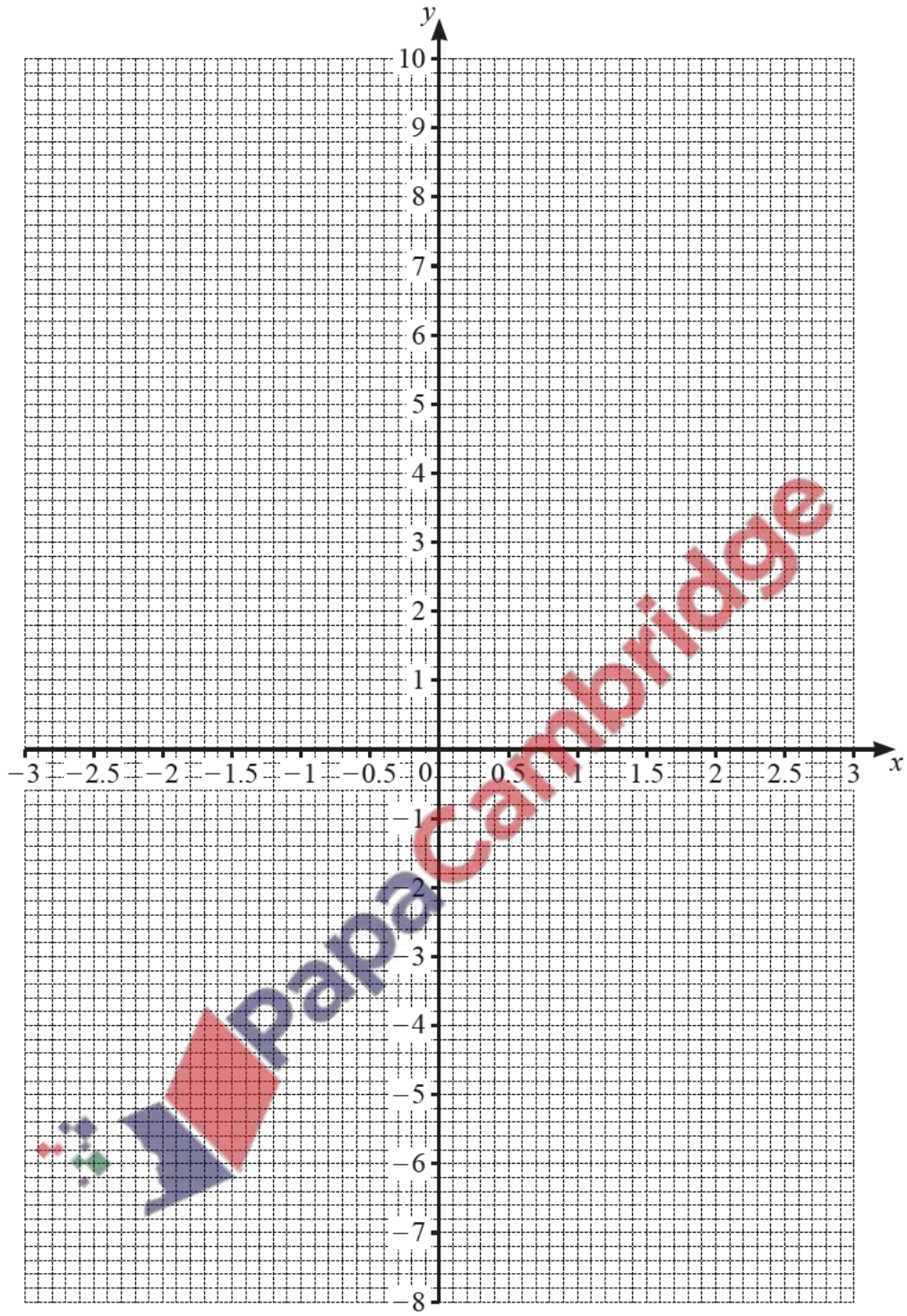
36. Nov/2021/Paper_41/No.6

The table shows some values for $y = x^2 - \frac{3}{2x}$, $x \neq 0$, given correct to 1 decimal place.

x	−3	−2	−1	−0.5	−0.2		0.2	0.5	1	2	3
y			2.5	3.3	7.5		−7.5	−2.8	−0.5	3.3	

(a) (i) Complete the table. [3]

(ii) On the grid, draw the graph of $y = x^2 - \frac{3}{2x}$ for $-3 \leqslant x \leqslant -0.2$ and $0.2 \leqslant x \leqslant 3$.



[5]

(b) By drawing a suitable straight line on the grid, solve the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ for $-3 \leqslant x \leqslant -0.2$ and $0.2 \leqslant x \leqslant 3$.

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

(c) The solutions to the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ are also the solutions to an equation of the form $ax^3 + bx^2 + cx - 15 = 0$ where a, b and c are integers.

Find the values of a, b and c.

$a =$ .....

$b =$ .....

$c =$ ..... [4]

37. Nov/2021/Paper_41/No.8

(a) $f(x) = 3 - 5x$

(i) Find x when $f(x) = -5$.

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

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

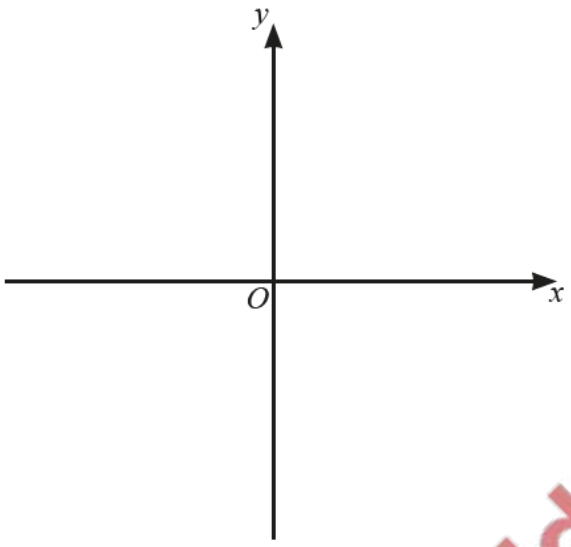
$f^{-1}(x) =$ ..... [2]

(b) $g(x) = 18 - 3x - x^2$

(i) Write $g(x)$ in the form $b - (a + x)^2$.

..... [3]

(ii) Sketch the graph of $y = g(x)$.
On your sketch, show the coordinates of the turning point.



[3]

(iii) Find the equation of the tangent to the graph of $y = 18 - 3x - x^2$ at $x = 4$.
Give your answer in the form $y = mx + c$.

$y =$ ..... [6]

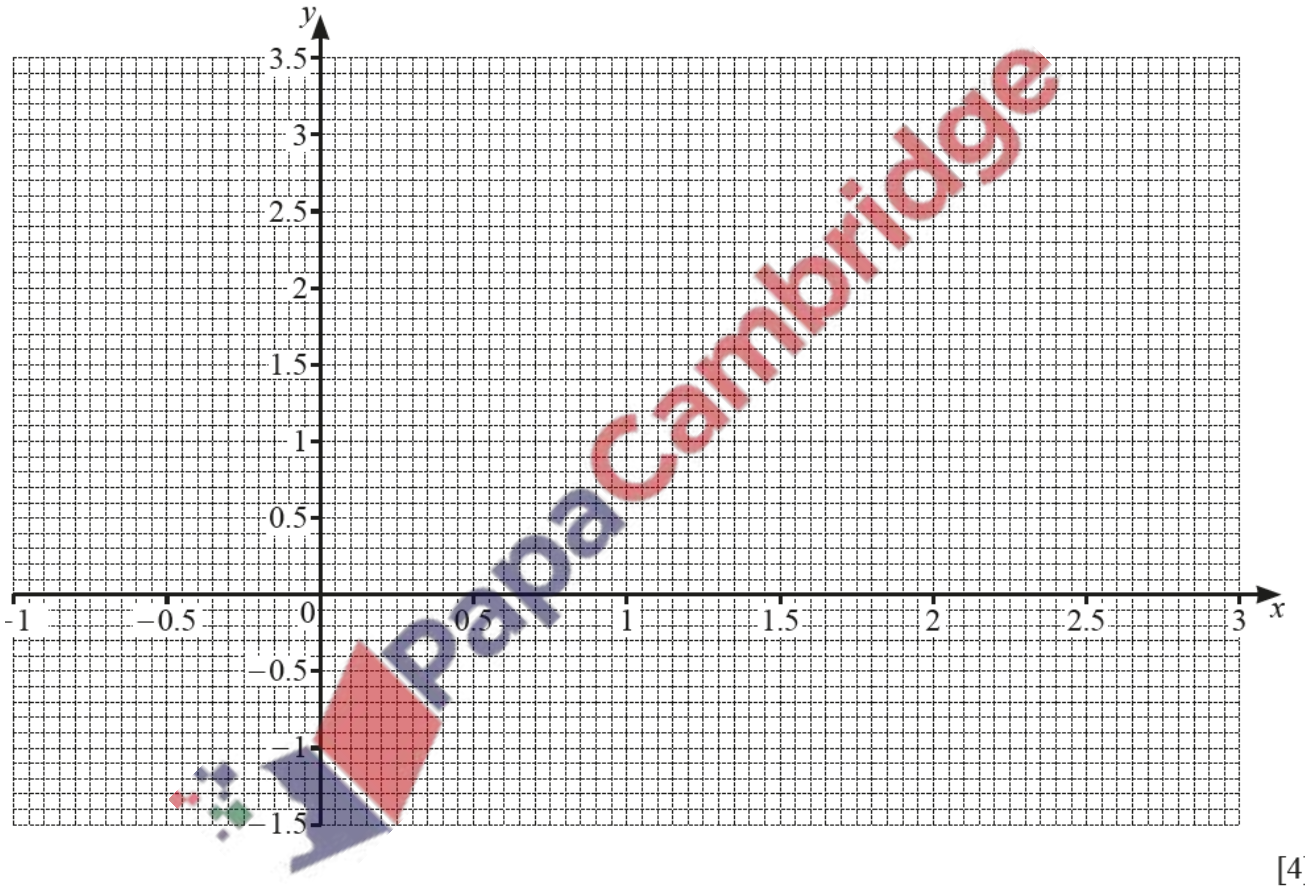
38. Nov/2021/Paper_42/No.5

The table shows some values for $y = x^3 - 3x^2 + 3$.

x	-1	-0.5	0	0.5	1	1.5	2	2.5	3
y		2.125	3	2.375	1		-1	-0.125	

(a) Complete the table. [3]

(b) On the grid, draw the graph of $y = x^3 - 3x^2 + 3$ for $-1 \leqslant x \leqslant 3$.



[4]

(c) By drawing a suitable straight line on the grid, solve the equation $x^3 - 3x^2 + x + 1 = 0$.

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

39. Nov/2021/Paper_42/No.6

(a) Solve.

(i) $4(2x-3)=24$

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

(ii) $6x+14>6$

..... [2]

(b) Rearrange the formula $V=2x^3-3y^3$ to make y the subject.

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

(c) Show that $(2n-5)^2-13$ is a multiple of 4 for all integer values of n.

[3]

(d) The expression $5+12x-2x^2$ can be written in the form $q-2(x+p)^2$.

(i) Find the value of p and the value of q.

$p =$ ..... , $q =$ ..... [3]

(ii) Write down the coordinates of the maximum point of the curve $y = 5+12x-2x^2$.

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

(e) The energy of a moving object is directly proportional to the square of its speed.
The speed of the object is increased by 30%.

Calculate the percentage increase in the energy of the object.

..... % [2]

40. Nov/2021/Paper_43/No.4

(a) Solve the simultaneous equations.
You must show all your working.

$$2p - q = 7$$
$$3p + 2q = 7$$

$p =$ .....

$q =$ ..... [3]

(b) Solve the equation.

$$\frac{x}{4} + \frac{2x}{3} = 1$$

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

(c) $-8 < 3x - 2 \leqslant 7$

(i) Solve the inequality.

..... [3]

(ii) Find the integer values of x that satisfy the inequality.

..... [1]

(d) Factorise completely.

$$16a - 4a^2$$

..... [2]

(e) Write each of the following as a single fraction, in its simplest form.

(i) $\frac{1}{2a} \div \frac{3}{4b}$

..... [2]

(ii) $2 - \frac{x}{x-1}$

..... [2]

41. Nov/2021/Paper_43/No.7c

(c) Alicia walks a distance of 9 km at a speed of x km/h.
She then runs a distance of 5 km at a speed of $(2x + 1)$ km/h.

The total time Alicia takes is 2.5 hours.

(i) Show that $10x^2 - 41x - 18 = 0$.

[4]

(ii) Work out Alicia's running speed.
You must show all your working.

..... km/h [4]

42. Nov/2021/Paper_43/No.9

$$f(x) = x(x-1)(x-2)$$

(a) Find the coordinates of the points where the graph of $y = f(x)$ crosses the x-axis.

(..... , ...)

(..... , ...)

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

(b) Show that $f(x) = x^3 - 3x^2 + 2x$.

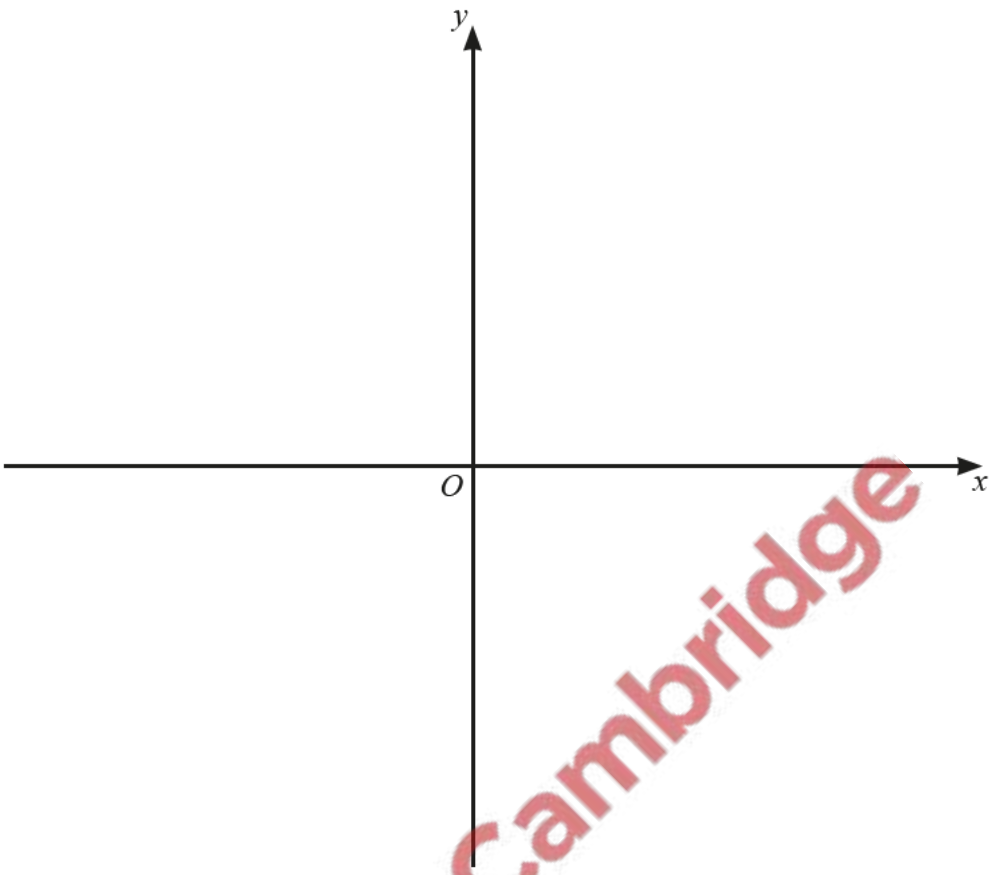
[2]

(c) Find the coordinates of the turning points of the graph of $y = f(x)$.
Show all your working and give your answers correct to 1 decimal place.

(..... , ...)

(..... , ...) [8]

(d) Sketch the graph of $y = \mathrm{f}(x)$.



[2]

43. Nov/2021/Paper_43/No.11

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

(a) Find the value of

(i) h(3),

..... [1]

(ii) fh(3).

..... [1]

(b) Solve the equation $gf(x) = 0$.

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

(c) $p^{-1}(x) = f(x)$

Find $p(x)$.

..... [2]

(d) $\mathrm{h}(x)\mathrm{j}(x) = \frac{1}{\sqrt{2}}$

Find the value of x.

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

44. March/2021/Paper_12/No.12

Factorise completely.

$$9t^2w - 3t$$

..... [2]

45. March/2021/Paper_12/No.14

These are the first four terms of a sequence.

29 22 15 8

(a) Write down the next two terms.

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

(b) Find the nth term.

..... [2]

46. March/2021/Paper_12/No.18

(a) Simplify.

(i) $x^{12} \div x^3$

..... [1]

(ii) $(y^2)^5$

..... [1]

(b) $3^p = \frac{1}{81}$

Find the value of p.

$p =$ ..... [1]

47. March/2021/Paper_12/No.20

Solve the simultaneous equations.
You must show all your working.

$$5x + 6y = 14$$
$$2x + 8y = 7$$

$x =$ .....

$y =$ ..... [4]

48. March/2021/Paper_22/No.14

(a) These are the first four terms of a sequence.

29 22 15 8

Write down the next two terms.

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

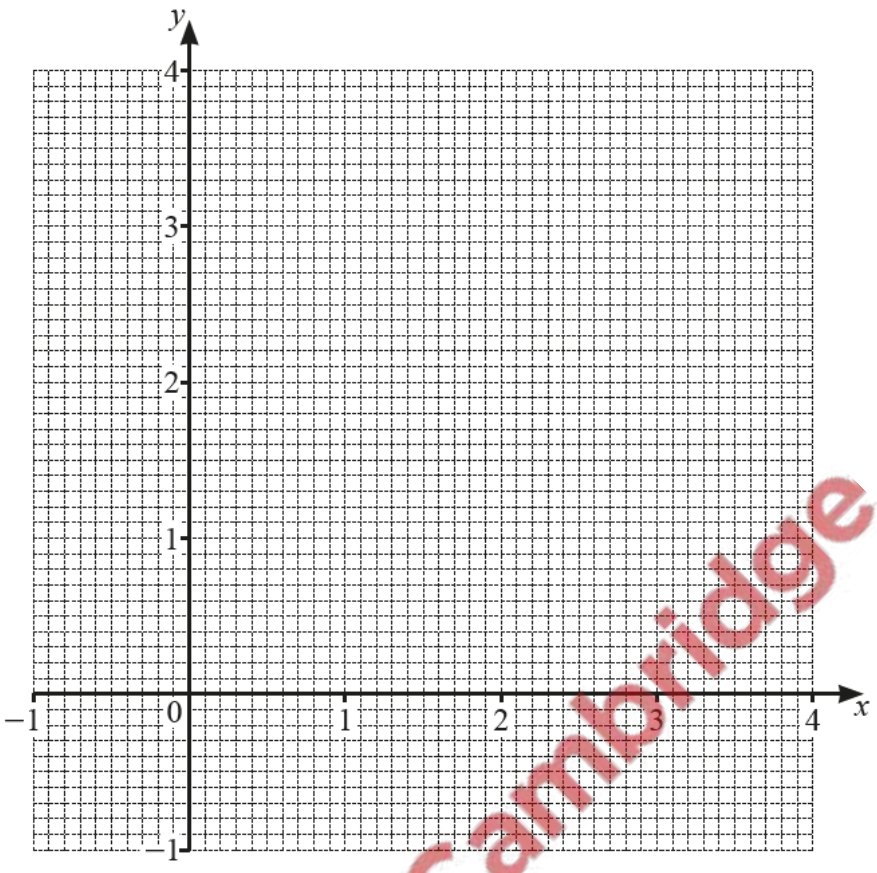
(b) These are the first five terms of another sequence.

4 7 12 19 28

Find the nth term.

..... [2]

49. March/2021/Paper_22/No.16



The region R satisfies these three inequalities.

$$y > 1 \qquad y < 2x + 2 \qquad x + y \leqslant 3$$

By drawing three suitable lines, and shading unwanted regions, find and label the region R. [5]

50. March/2021/Paper_22/No.18

Simplify $\left(343x^9\right)^{\frac{2}{3}}$.

..... [2]

51. March/2021/Paper_22/No.19

Solve the simultaneous equations.
You must show all your working.

$$x - y = 7$$
$$x^2 + y = 149$$

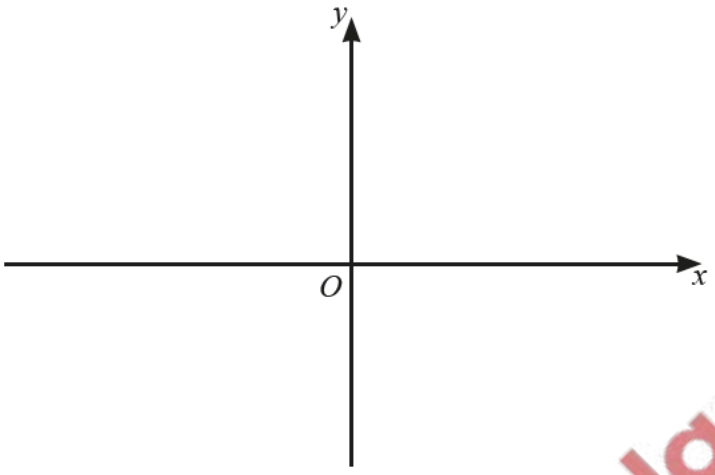
$x =$ ..... $y =$ .....

$x =$ ..... $y =$ ..... [5]

52. March/2021/Paper_22/No.21

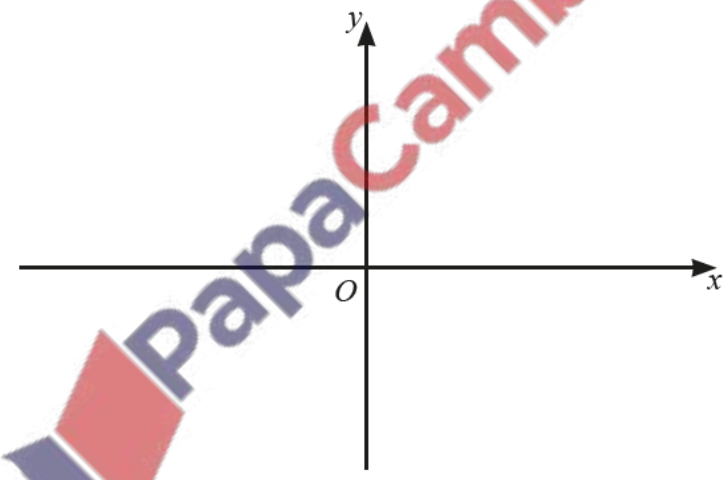
On the axes, sketch the graph of each of these functions.

(a) $y = \frac{1}{x}$



[2]

(b) $y = 4^x$



[2]

53. March/2021/Paper_22/No.24

A curve has equation $y = x^3 - 2x^2 + 5$.

Find the coordinates of its two stationary points.

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

54. March/2021/Paper_32/No.4

The scale drawing shows the positions of Kendra's house, K, and Latika's house, L, on a map.

(a) Jesminder's house, J, is on a bearing of 036° from K and on a bearing of 284° from L.

Mark the position of J on the map. [2]

(b) The actual distance between K and L is 9600 metres.

(i) Complete the scale of the map.

1 cm represents ..... metres [2]

(ii) Kendra walks from K to L at a constant speed of 4.5 km/h.
She leaves K at 10 15.

Work out the time she arrives at L.

..... [3]

(c) (i) Kendra and Latika leave Latika's house at 1500 to go to the cinema.

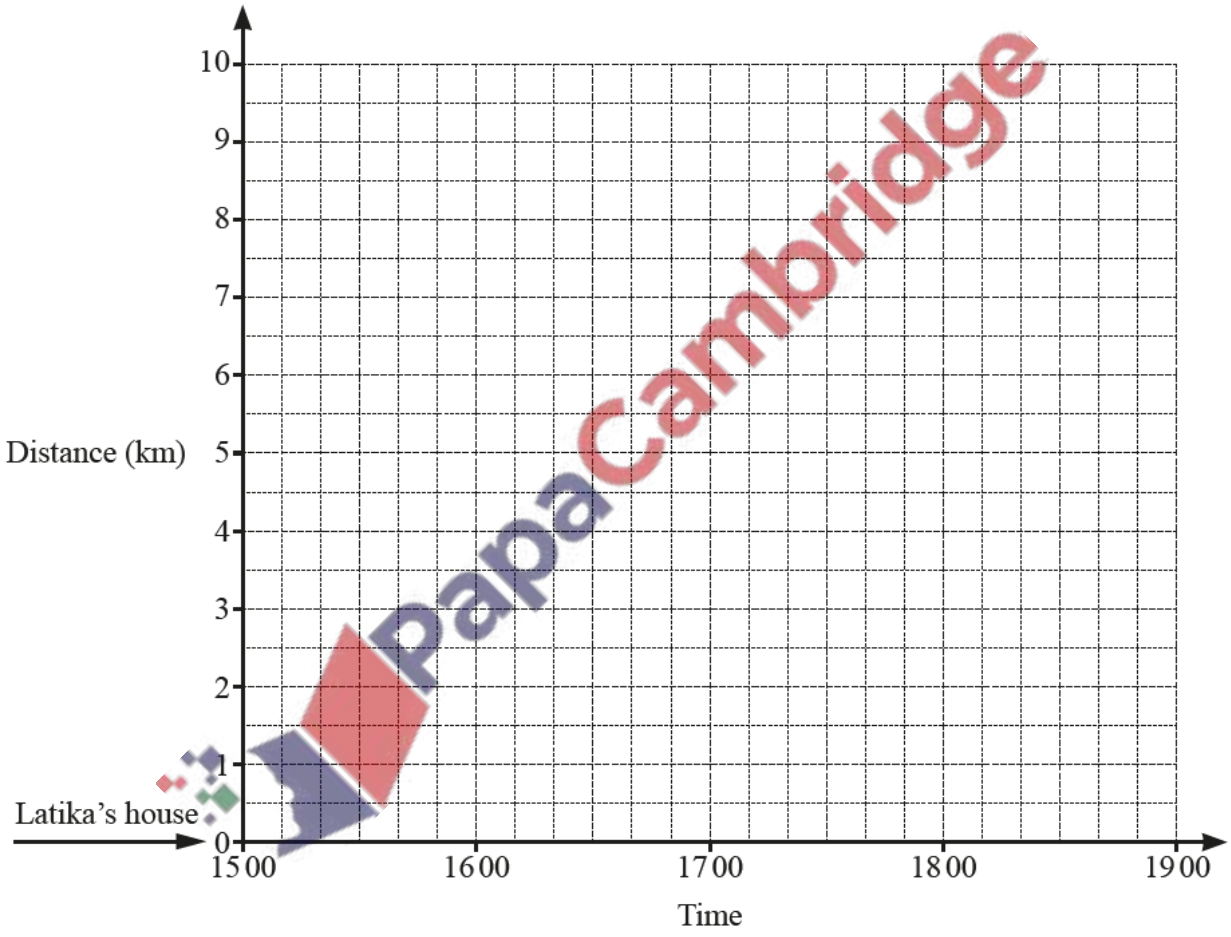
(a) They walk for 20 minutes at a constant speed of 4.5 km/h.

Work out the distance they walk.

..... km [1]

(b) After walking for 20 minutes, they then run a distance of 6 km at a constant speed for 40 minutes.

Draw their journey to the cinema on the travel graph.



[2]

(ii) Kendra and Latika leave the cinema at 1805.
They travel back to Latika's house in a taxi at a constant speed of 30 km/h.

Complete the travel graph.

[2]

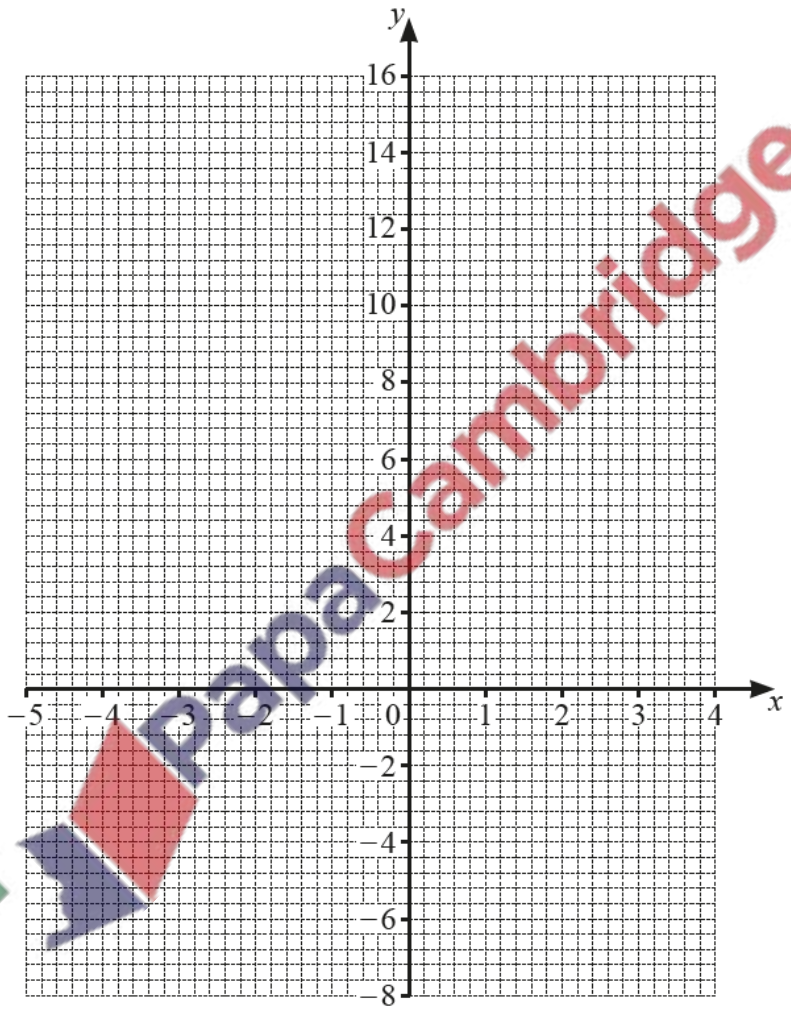
55. March/2021/Paper_32/No.5

(a) Complete the table of values for $y = -x^2 - x + 14$.

x	–5	–4	–3	–2	–1	0	1	2	3	4
y			8	12			12	8		

[3]

(b) On the grid, draw the graph of $y = -x^2 - x + 14$ for $-5 \leqslant x \leqslant 4$.



[4]

(c) **(i)** Write down the equation of the line of symmetry of the graph.

..... [1]

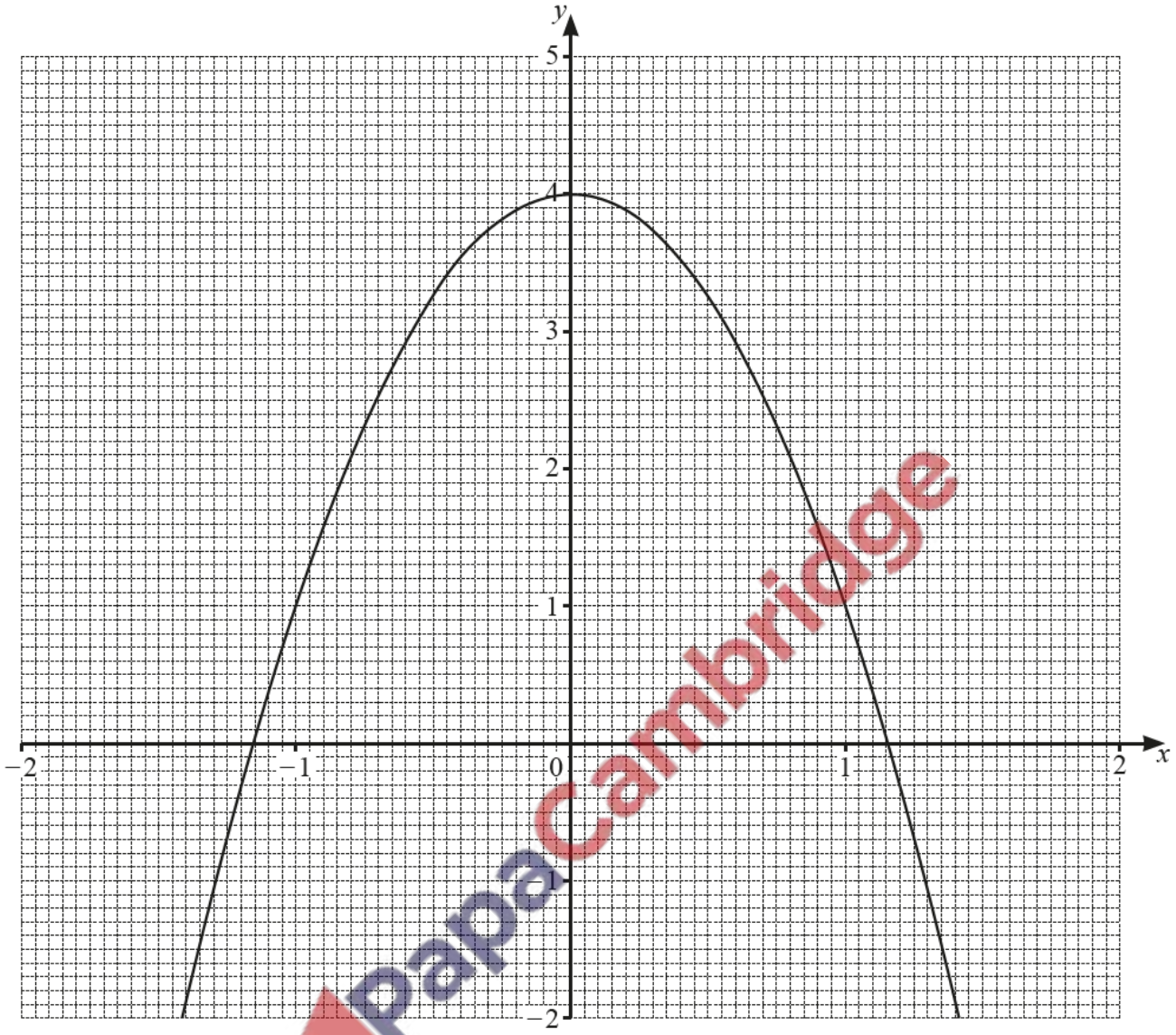
(ii) Find the coordinates of the highest point on the graph.

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

(d) Use your graph to solve the equation $-x^2 - x + 14 = -2$.

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

56. March/2021/Paper_42/No.6



(a) The grid shows the graph of $y = a + bx^2$.

The graph passes through the points with coordinates (0, 4) and (1, 1).

(i) Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [2]

(ii) Write down the equation of the tangent to the graph at (0, 4).

..... [1]

(iii) The equation of the tangent to the graph at $x = -1$ is $y = 6x + 7$.

Find the equation of the tangent to the graph at $x = 1$.

..... [2]

(b) The table shows some values for $y = 1 + \frac{5}{3-x}$ for $-2 \leqslant x \leqslant 1.5$.

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5
y	2	2.11		2.43		3		4.33

(i) Complete the table. [3]

(ii) On the grid, draw the graph of $y = 1 + \frac{5}{3-x}$ for $-2 \leqslant x \leqslant 1.5$. [4]

(c) **(i)** Write down the values of x where the two graphs intersect.

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

(ii) The answers to **part(c)(i)** are two solutions of a cubic equation in terms of x.

Find this equation in the form $ax^3 + bx^2 + cx + d = 0$, where a, b, c and d are integers.

..... [4]

57. March/2021/Paper_42/No.9

(a) Factorise.

(i) $5am+10ap-bm-2bp$

..... [2]

(ii) $15(k+g)^2-20(k+g)$

..... [2]

(iii) $4x^2-y^4$

..... [2]

(b) Expand and simplify.

$$(x-3)(x+1)(3x-4)$$

..... [3]

(c) $(x+a)^2 = x^2 + 22x + b$

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [2]

58. March/2021/Paper_42/No.11

Gaya spends \$48 to buy books that cost \$$x$ each.

(a) Write down an expression, in terms of x, for the number of books Gaya buys.

..... [1]

(b) Myra spends \$60 to buy books that cost \$$(x+2)$ each.
Gaya buys 4 more books than Myra.

Show that $x^2 + 5x - 24 = 0$.

[4]

(c) Solve by factorisation.

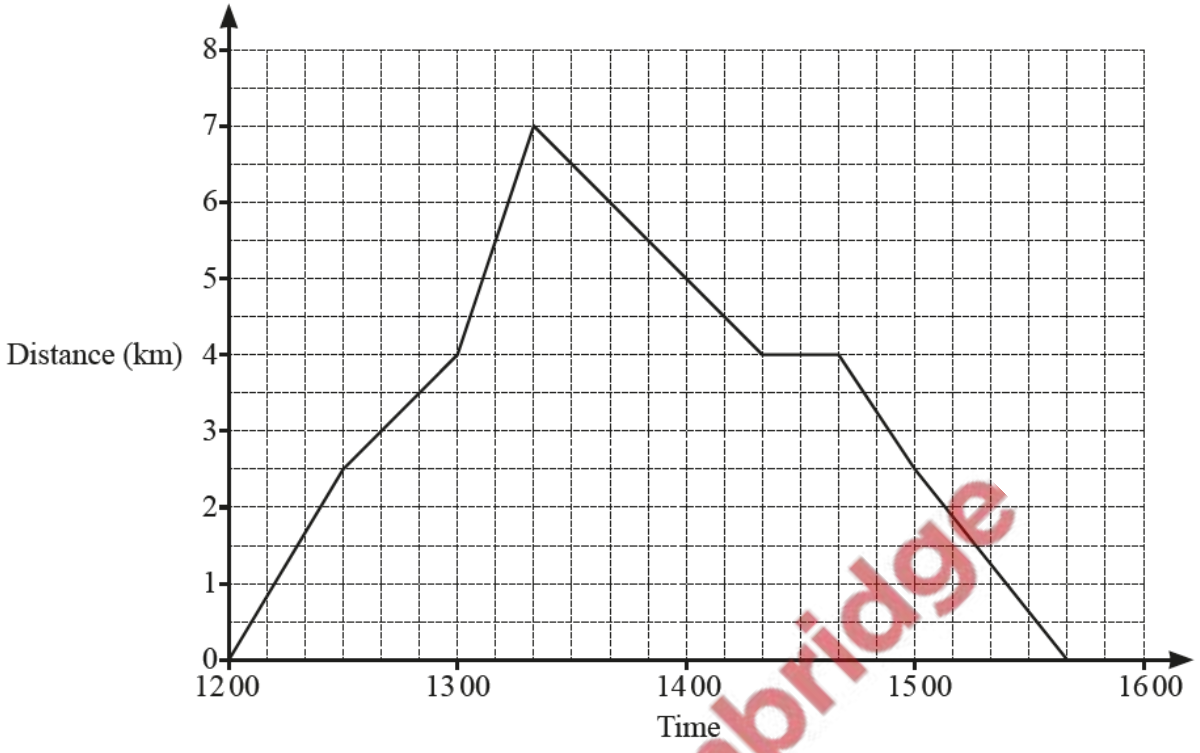
$x^2 + 5x - 24 = 0$

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

(d) Find the number of books Myra buys.

..... [1]

59. June/2021/Paper_11/No.6



The travel graph shows a student's journey.

(a) Explain what is happening between 1420 and 1440.

..... [1]

(b) Complete the statement.

The student is travelling fastest between the times ..... and .....

because ..... [2]

60. June/2021/Paper_11/No.12

The nth term of a sequence is $6n-4$.

(a) Write down the first 3 terms in this sequence.

....., ..., ... [1]

(b) The kth term of this sequence is 422.

Work out the value of k.

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

61. June/2021/Paper_11/No.22

There is a straight road between town A and town B of length 130 km.

Maxi travels from town A to town B.
Pippa travels from town B to town A.
Both travel at a constant speed of 40 km/h.
Maxi leaves 30 minutes before Pippa.

Work out how far from town A they will be when they pass each other.

..... km [4]

62. June/2021/Paper_12/No.24

Expand and simplify.

$$5(2x-7)-3(x-5)$$

..... [2]

63. June/2021/Paper_13/No.11

Maria buys n pencils that cost p cents each.
She pays with a \$$y$ note.

Find, in terms of n, p and y, the amount of change Maria receives.
Give your answer in cents.

..... cents [2]

64. June/2021/Paper_13/No.15

Expand and simplify.

$$6(t-q)-2(t-3q)$$

..... [2]

65. June/2021/Paper_13/No.17

These are the first four terms of a sequence.

7 11 15 19

Find the nth term.

..... [2]

66. June/2021/Paper_21/No.6

(a) The nth term of a sequence is $n^2 + 3n$.

Find the first three terms of this sequence.

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

(b) These are the first five terms of a different sequence.

25 18 11 4 −3

Find the nth term of this sequence.

..... [2]

67. June/2021/Paper_21/No.7

Solve the simultaneous equations.
You must show all your working.

$$2x + y = 3$$
$$x - 5y = 40$$

$x =$ .....

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

68. June/2021/Paper_21/No.11

(a) Simplify fully.

$$(4ab^5)^4$$

..... [2]

(b) $2p^{\frac{1}{3}} = 6$

Find the value of p.

$p =$ ..... [1]

(c) $81^2 \div 3^t = 9$

Find the value of t.

$t =$ ..... [2]

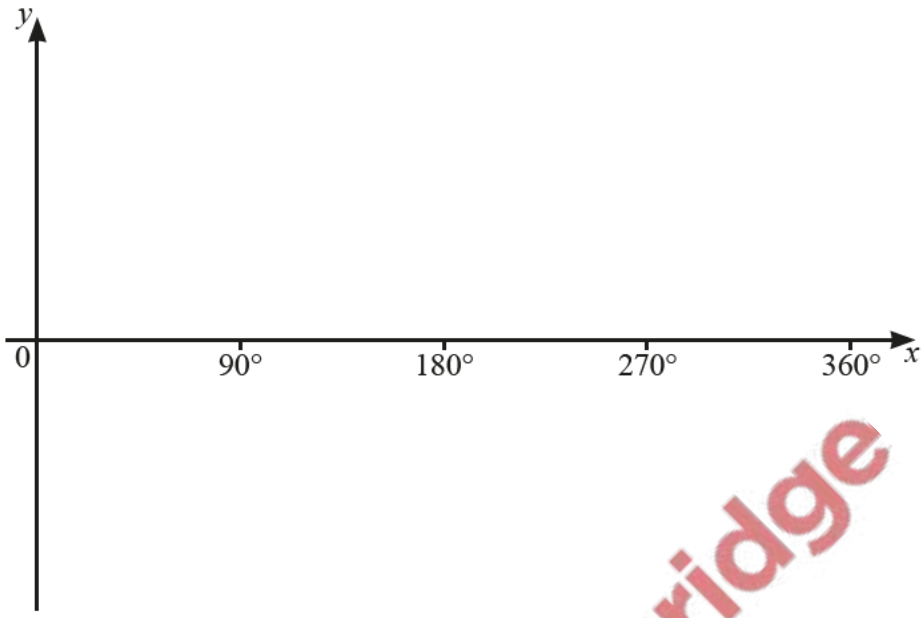
69. June/2021/Paper_21/No.15

Make h the subject of the formula $2mh = g(1-h)$.

$h =$ ..... [4]

70. June/2021/Paper_21/No.19

(a) Sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$.



[2]

(b) Solve the equation $5 \tan x = 1$ for $0° \leqslant x \leqslant 360°$.

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

71. June/2021/Paper_22/No.8

$$a = \frac{b^2}{5c}$$

Find b when $a = 5.625$ and $c = 2$.

$b =$ ..... [2]

72. June/2021/Paper_22/No.18

$f(x) = x^2 - 25$ $\quad$ $g(x) = x + 4$

Solve $fg(x+1) = gf(x)$.

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

73. June/2021/Paper_22/No.20

Expand and simplify.

$$(x-2)(2x+5)(x+3)$$

..... [3]

74. June/2021/Paper_22/No.22

Simplify.

$$\frac{2x^2 - 5x - 12}{3x^2 - 12x}$$

..... [4]

75. June/2021/Paper_22/No.24

Solve.

$$\frac{1}{x+1}+\frac{9}{x+9}=1$$

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

76. June/2021/Paper_23/No.6

Maria buys n pencils that cost p cents each.
She pays with a $\$y$ note.

Find, in terms of n, p and y, the amount of change Maria receives.
Give your answer in cents.

..... cents [2]

77. June/2021/Paper_23/No.11

Simplify $3x^3 \times 4x^4$.

..... [2]

78. June/2021/Paper_23/No.12

x is an integer and $-3 \leqslant 2x-1 < 3$.

Find the values of x.

..... [2]

79. June/2021/Paper_23/No.13

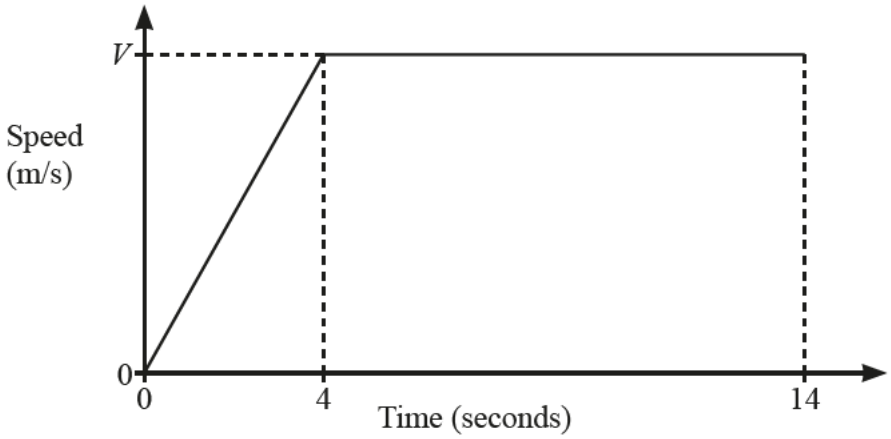
Expand and simplify.

$$6(t-q)-2(t-3q)$$

..... [2]

80. June/2021/Paper_23/No.18

A car starts from rest and accelerates at a rate of 3 m/s^2 for 4 seconds.
The car then travels at a constant speed for 10 seconds.



NOT TO SCALE

The diagram shows the speed–time graph for this journey.

(a) Find the value of V.

$V =$ ..... [1]

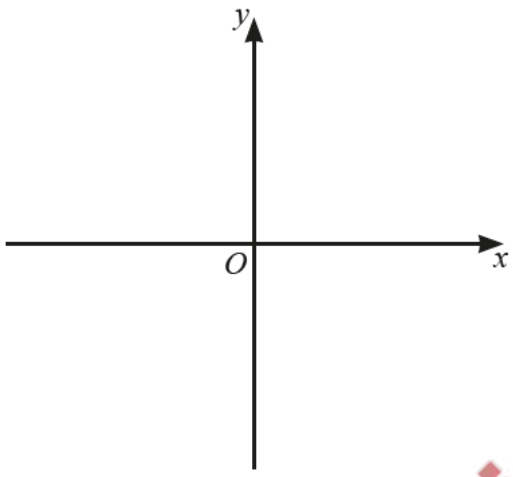
(b) Calculate the total distance travelled by the car during the 14 seconds.

..... m [2]

81. June/2021/Paper_23/No.24

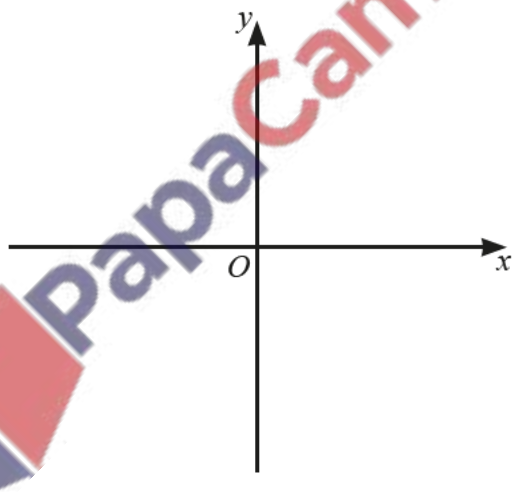
On the axes, sketch the graph of each of these functions.

(a) $y = \frac{2}{x}$



[2]

(b) $y = 2^{-x}$



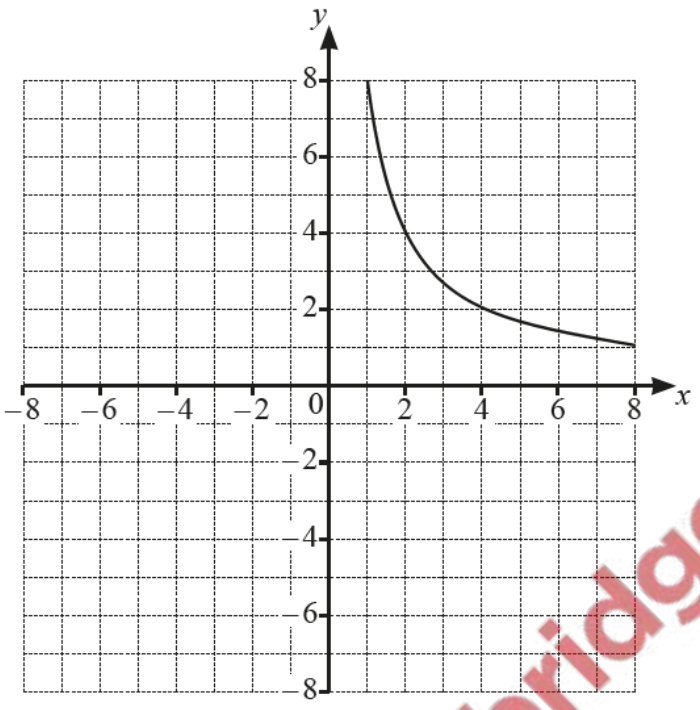
[2]

82. June/2021/Paper_23/No.25

Find the x-coordinates of the points on the graph of $y = x^5 - 5x^4$ where the gradient is 0.

..... [4]

83. June/2021/Paper_31/No.5



The diagram shows the graph of $y = \frac{k}{x}$ for $1 \leqslant x \leqslant 8$.

(a) Use the graph to find the value of x when $y = 4$.

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

(b) **(i)** Show that $k = 8$.

[1]

(ii) Calculate the value of y when $x = 250$.

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

(c) **(i)** Complete this table of values for $y = \frac{8}{x}$.

x	-8	-4	-2	-1
y				

[2]

(ii) On the grid, draw the graph of $y = \frac{8}{x}$ for $-8 \leqslant x \leqslant -1$. [3]

(d) Write down the equation of each line of symmetry of the graph.

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

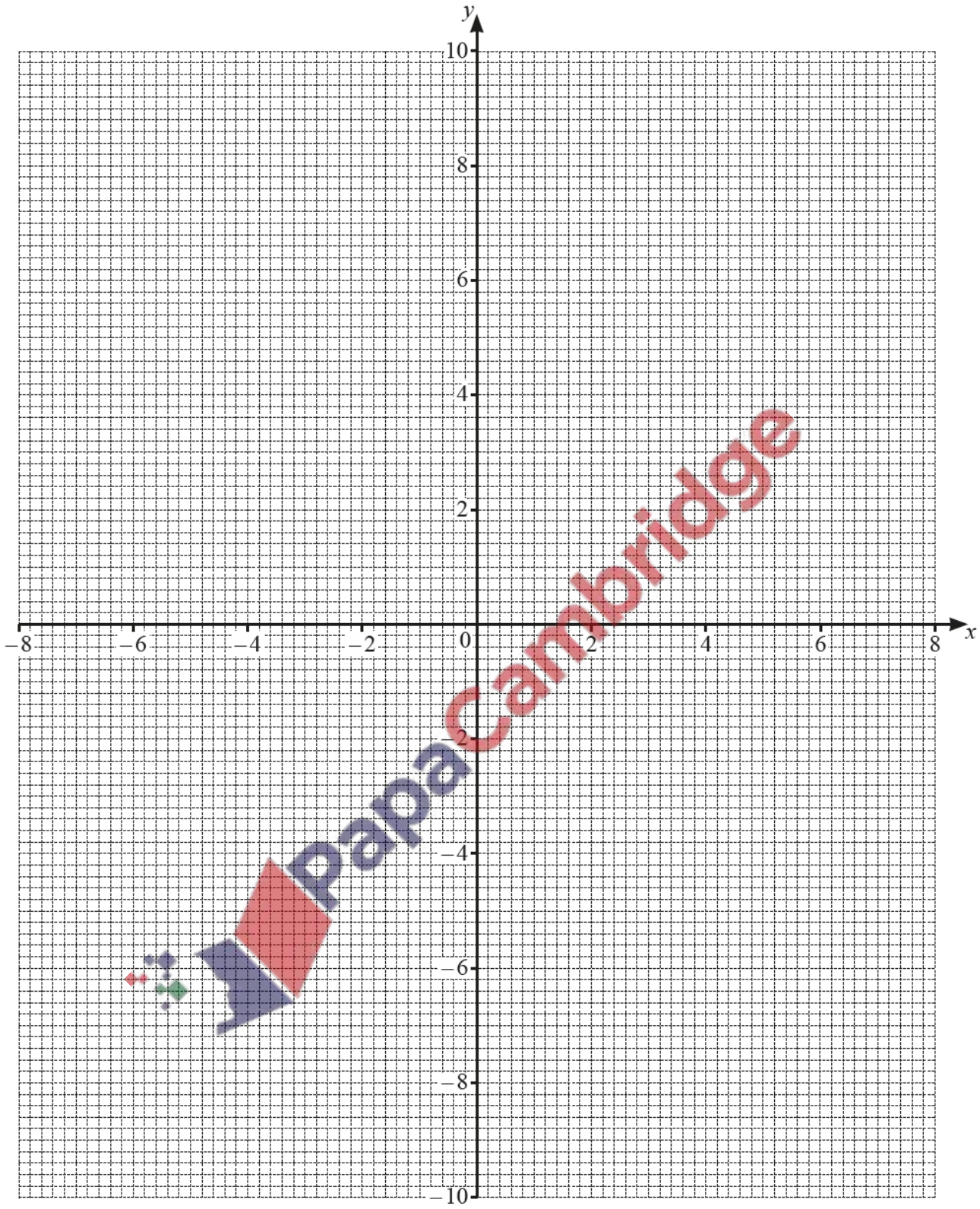
84. June/2021/Paper_32/No.5

(a) Complete the table of values for $y = \frac{18}{x}$.

x	-8	-6	-4	-3	-2		2	3	4	6	8
y		-3		-6				6		3	

[3]

(b) On the grid, draw the graph of $y = \frac{18}{x}$ for $-8 \leqslant x \leqslant -2$ and $2 \leqslant x \leqslant 8$.



[4]

(c) Write down the order of rotational symmetry of the graph.

..... [1]

(d) **(i)** On the grid, plot and join the points $(-8, -3)$ and $(6, 4)$. [2]

(ii) Write down the values of x where this line intersects the graph of $y = \frac{18}{x}$.

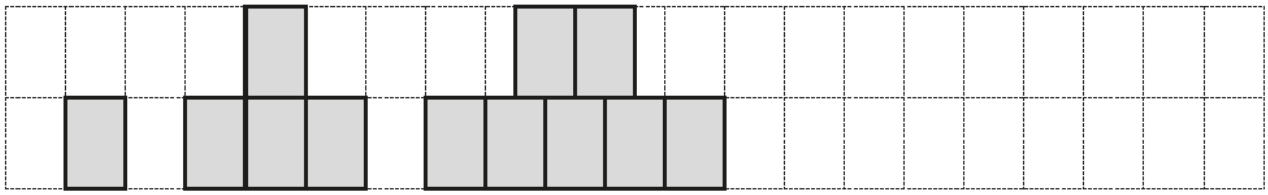
$x =$ ..... and $x =$ ..... [2]

(iii) Find the equation of this line in the form $y = mx + c$.

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

85. June/2021/Paper_32/No.9

A sequence of patterns is made using rectangular blocks.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

(a) Draw Pattern 4. [1]

(b) Complete the table.

Pattern number	1	2	3	4	5
Number of blocks	1	4	7		

[2]

(c) Find an expression, in terms of n, for the number of blocks in Pattern n.

..... [2]

(d) Tara wants to make one pattern in this sequence.
She has 84 blocks.

Work out the largest pattern number she can make and the number of blocks remaining.

Pattern number .....

Number of blocks remaining ..... [4]

86. June/2021/Paper_33/No.4

(a) Simplify.

$3a-5b+2a+b$

..... [2]

(b) $P = 3x^2 - xy$

Find the value of y when $P = 90$ and $x = 5$.

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

(c) Factorise completely.

(i) $6x-18$

..... [1]

(ii) $25x^2 + 10x$

..... [2]

(d) $T = 8d - 3$

Make d the subject of this formula.

$d =$ ..... [2]

(e) Solve these equations.

(i) $\frac{x}{6} = 12$

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

(ii) $7x - 4 = 3x + 2$

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

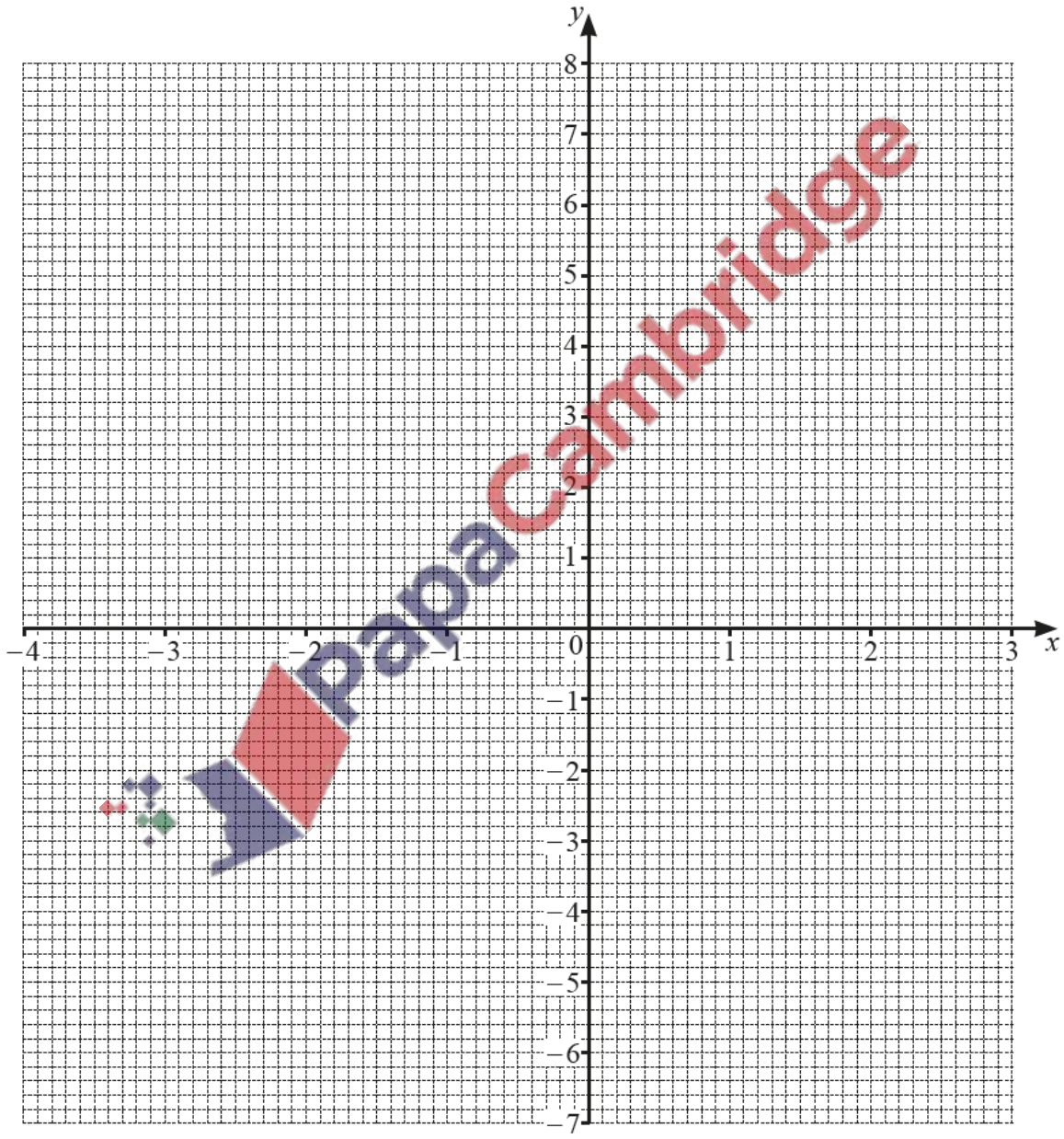
87. June/2021/Paper_33/No.9

The table shows some values for $y = x^2 + x - 5$.

x	-4	-3	-2	-1	0	1	2	3
y	7		-3	-5	-5			7

(a) Complete the table. [2]

(b) Draw the graph of $y = x^2 + x - 5$ for $-4 \leqslant x \leqslant 3$.



[4]

(c) Write down the equation of the line of symmetry of this graph.

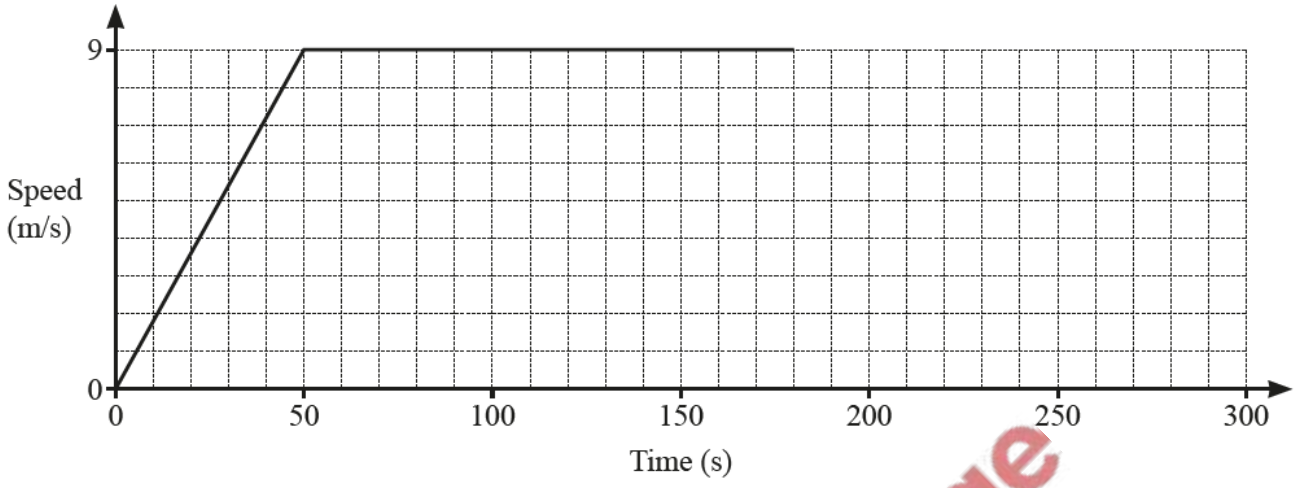
..... [1]

(d) Use the graph to solve the equation $x^2 + x - 5 = 0$.

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

88. June/2021/Paper_41/No.2

The diagram shows the speed–time graph for the first 180 seconds of a train journey.



(a) Find the acceleration, in m/s^2, of the train during the first 50 seconds.

..... m/s^2 [1]

(b) After 180 seconds, the train decelerates at a constant rate of 1944 $\mathbf{km/h^2}$.

Show that the train decelerates for 60 seconds until it stops.

[2]

(c) Complete the speed–time graph. [1]

(d) Calculate the average speed of the train for the whole journey.

..... m/s [4]

89. June/2021/Paper_41/No.7

(a) Simplify.

$$\frac{x^2-25}{x^2-x-20}$$

..... [3]

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

$$\frac{x+5}{x}+\frac{x+8}{x-1}$$

..... [3]

(c) A curve has equation $y = 2x^3 - 4x^2 + 6$.

(i) Find $\frac{dy}{dx}$, the derived function of y.

..... [2]

(ii) Calculate the gradient of the curve $y = 2x^3 - 4x^2 + 6$ at $x = 4$.

..... [2]

(iii) Find the coordinates of the two stationary points on the curve.

(..... , ...) and (..... , ...) [4]

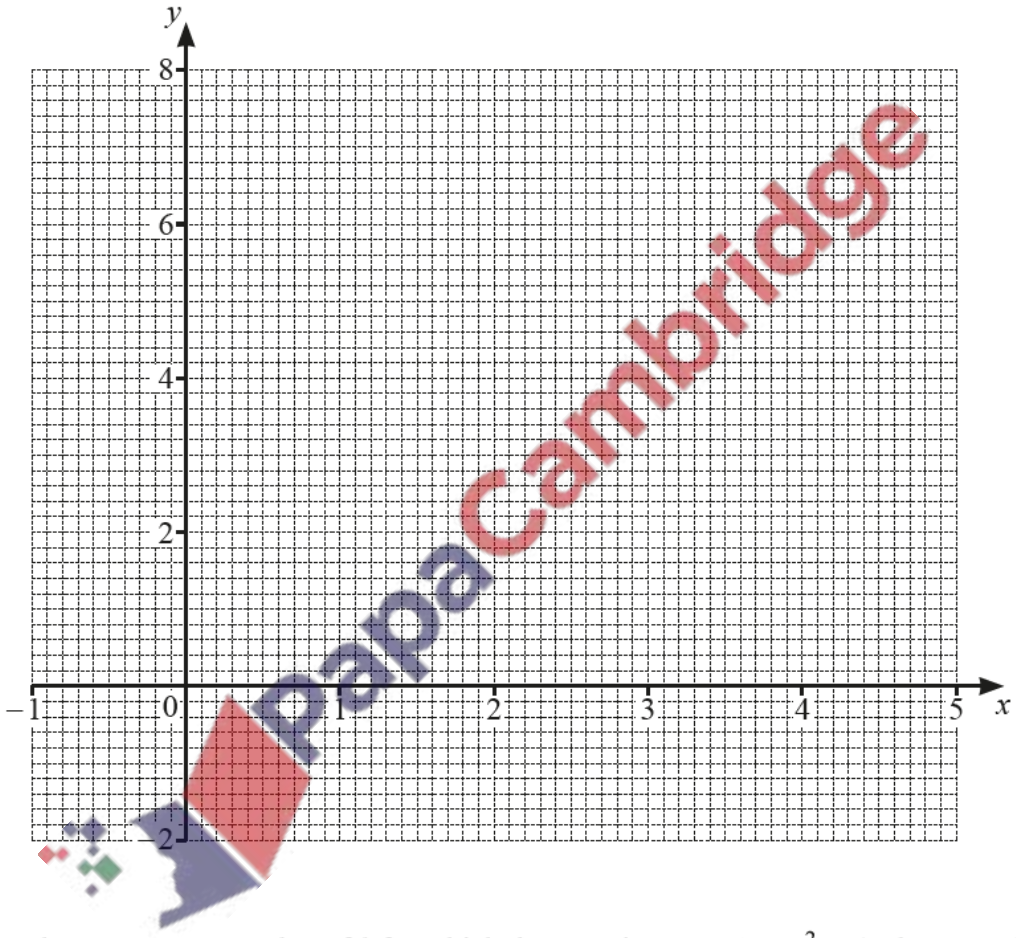
90. June/2021/Paper_41/No.10

The table shows some values of $y = 3+4x-x^2$ for $-1 \leqslant x \leqslant 5$.

x	-1	-0.5	0	1	2	3	4	4.5	5
y	-2			6		6			-2

(a) Complete the table. [3]

(b) On the grid, draw the graph of $y = 3+4x-x^2$ for $-1 \leqslant x \leqslant 5$.



[4]

(c) Write down an **integer** value of k for which the equation $3+4x-x^2 = k$ has no solutions.

..... [1]

(d) By drawing a suitable straight line on the grid, solve the equation $-1+\frac{9}{2}x-x^2=0$.

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

91. June/2021/Paper_41/No.12

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

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

..... [1]

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

..... [2]

(c) Solve $g(x) = f(x) + 37$.

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

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

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

(e) Find $hf(x) + g(x)$.
Give your answer in its simplest form.

..... [5]

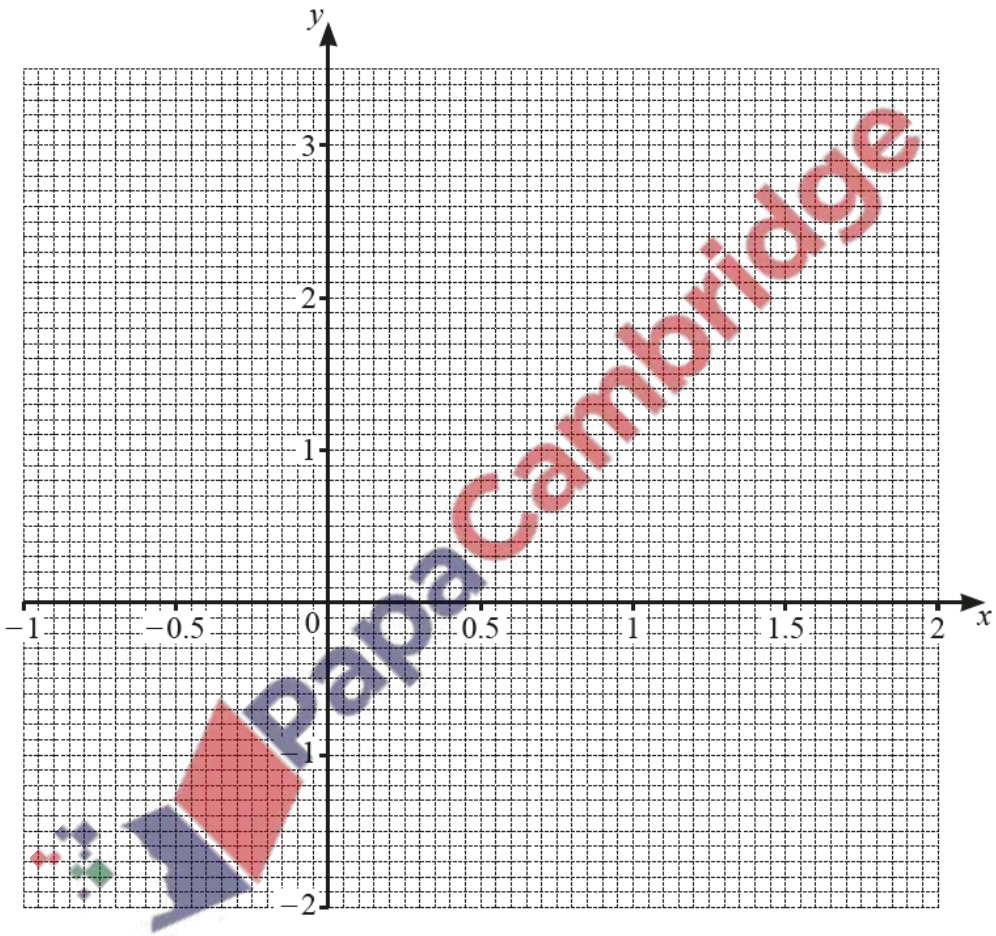
92. June/2021/Paper_42/No.2

The table shows some values for $y = 2 \times 0.5^x - 1$.

x	-1	-0.5	0	0.5	1	1.5	2
y	3	1.83		0.41	0	-0.29	

(a) (i) Complete the table. [2]

(ii) On the grid, draw the graph of $y = 2 \times 0.5^x - 1$ for $-1 \leqslant x \leqslant 2$.



[4]

(b) By drawing a suitable straight line, solve the equation $2 \times 0.5^x + 2x - 3.5 = 0$ for $-1 \leqslant x \leqslant 2$.

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

(c) There are no solutions to the equation $2 \times 0.5^x - 1 = k$ where k is an integer.

Complete the following statements.

The highest possible value of k is .....

The equation of the asymptote to the graph of $y = 2 \times 0.5^x - 1$ is ..... [2]

93. June/2021/Paper_42/No.3

(a) Simplify, giving your answer as a single power of 7.

(i) $7^5 \times 7^6$

..... [1]

(ii) $7^{15} \div 7^5$

..... [1]

(iii) $42 + 7$

..... [1]

(b) Simplify.

$(5x^2 \times 2xy^4)^3$

..... [3]

(c) $P = 2^5 \times 3^3 \times 7$ $Q = 540$

(i) Find the highest common factor (HCF) of P and Q.

..... [2]

(ii) Find the lowest common multiple (LCM) of P and Q.

..... [2]

(iii) $P \times R$ is a cube number, where R is an integer.

Find the smallest possible value of R.

..... [2]

(d) Factorise the following completely.

(i) $x^2 - 3x - 28$

..... [2]

(ii) $7(a+2b)^2 + 4a(a+2b)$

..... [2]

(e) $3^{2x-1} = \frac{1}{9^x} \times 3^{2y-x}$

Find an expression for y in terms of x.

$y =$ ..... [4]

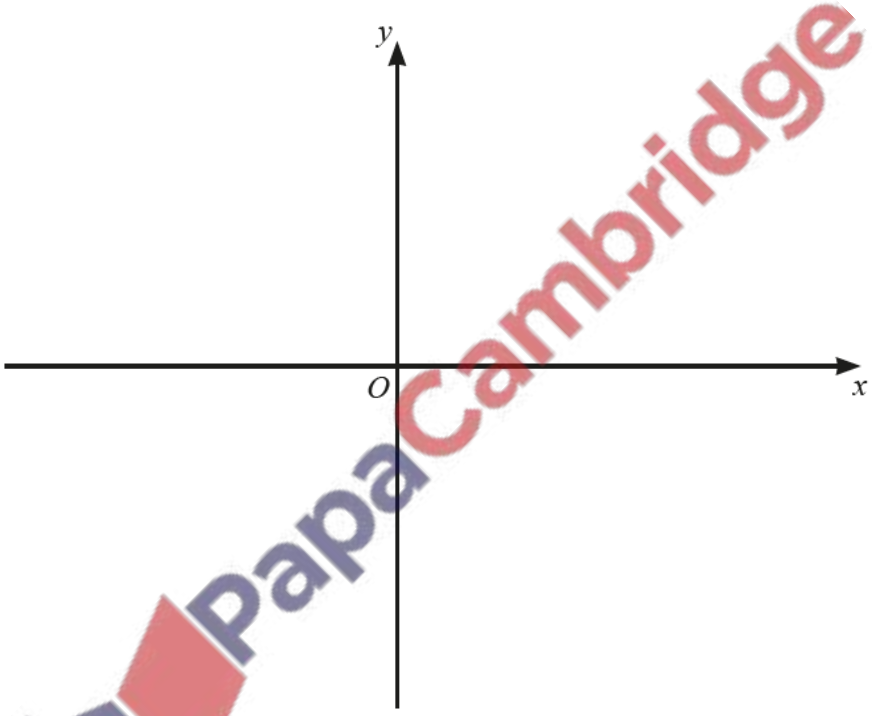
94. June/2021/Paper_42/No.9

(a) **(i)** The equation $y = x^3 - 4x^2 + 4x$ can be written as $y = x(x-a)^2$.

Find the value of a.

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

(ii) On the axes, sketch the graph of $y = x^3 - 4x^2 + 4x$, indicating the values where the graph meets the axes.



[4]

(b) Find the equation of the tangent to the graph of $y = x^3 - 4x^2 + 4x$ at $x = 4$.
Give your answer in the form $y = mx + c$.

$y =$ ..... [7]

95. June/2021/Paper_42/No.10

The table shows four sequences A, B, C and D.

Sequence	1st term	2nd term	3rd term	4th term	5th term		nth term
A	1	8	27	64			
B	5	11	17	23			
C	0.25	0.5	1	2	4		
D	4.75	10.5	16	21			

Complete the table.

[9]

96. June/2021/Paper_43/No.2

(a) $y = px^2 + t$

(i) Find the value of y when $p = 3$, $x = 2$ and $t = -13$.

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

(ii) Rearrange the formula to write x in terms of p, t and y.

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

(b) (i) Factorise.

$15x^2 - 2x - 8$

..... [2]

(ii) Solve the equation.

$15x^2 - 2x - 8 = 0$

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

(c) Factorise completely.

$x^3 - 16xy^2$

..... [3]

(d) Simplify. $\dfrac{2x-1-4ax+2a}{2x^2-x}$

..... [4]

97. June/2021/Paper_43/No.5

Solve the simultaneous equations.

(a) $x+2y=13$
$x+5y=22$

$x =$ .....

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

(b) $y=2-x$
$y=x^2+2x+2$

$x =$ ..... $y =$ .....

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

98. June/2021/Paper_43/No.7

(a)

Write down the inequality in x shown by the number line.

..... [2]

(b) (i) Write x^2+4x+1 in the form $(x+p)^2+q$.

..... [2]

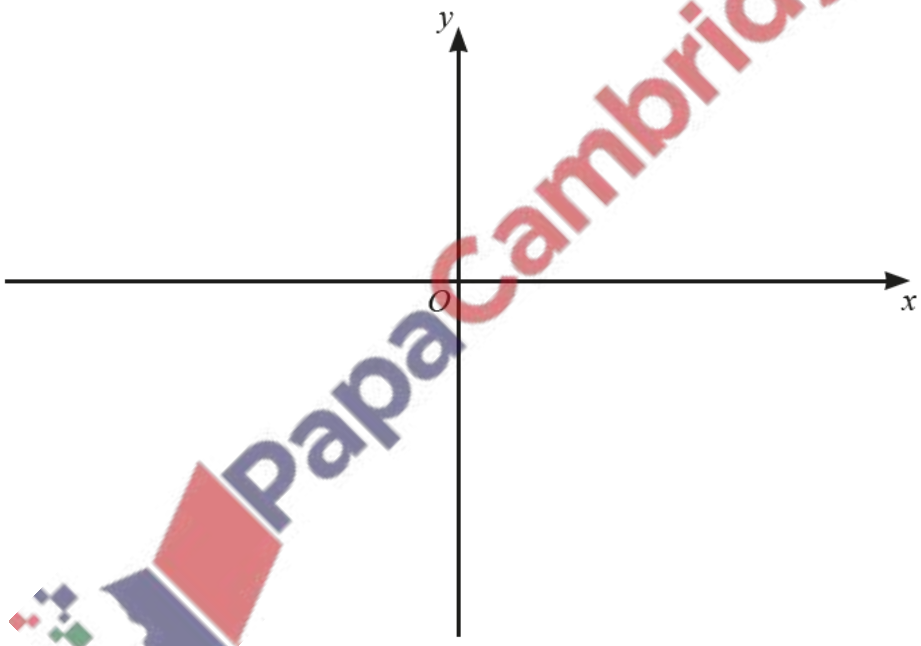
(ii) Use your answer to **part (b)(i)** to solve the equation $x^2+4x+1=0$.

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

(iii) Use your answer to **part (b)(i)** to write down the coordinates of the minimum point on the graph of $y = x^2 + 4x + 1$.

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

(iv) On the diagram, sketch the graph of $y = x^2 + 4x + 1$.



[2]

99. June/2021/Paper_43/No.10

$f(x) = 3x - 2$ $g(x) = 5x - 7$ $h(x) = x^2 + x$ $j(x) = 3^x$

(a) Find

(i) f(2),

..... [1]

(ii) g(2),

..... [1]

(iii) gf(2).

..... [1]

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

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

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

..... [3]

(d) Find the derivative of h(x).

..... [1]

(e) **(i)** Find x when $\mathrm{j}^{-1}(x) = 4$.

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

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

..... [1]

100. June/2021/Paper_43/No.11

(a) These are the first four terms of a sequence.

11 7 3 −1

(i) Write down the next term.

..... [1]

(ii) Write down the term to term rule for this sequence.

..... [1]

(iii) Find the nth term of this sequence.

..... [2]

(b) The nth term of a different sequence is $\frac{2n}{n+1}$.

(i) Find the difference between the 5th term and the 6th term of this sequence.
Give your answer as a fraction.

..... [2]

(ii) Is $\frac{3}{4}$ a term in this sequence?
Show how you decide.

[3]