Algebra and graphs – 2022 Nov IGCSE 0580 Math

1. Nov/2022/Paper_0580_11/No.17

(a) 3, 9, 27, 81, …

Write down the term to term rule for this sequence.

..... [1]

(b) 13, 17, 21, 25, …

Find the nth term of this sequence.

..... [2]

2. Nov/2022/Paper_0580_11/No.23

Natalie buys 4 tomato plants and 3 pepper plants for $9.35 .
Samir buys 2 tomato plants and 11 pepper plants for $16.55 .

Write down a pair of simultaneous equations and solve them to find the cost of one tomato plant and the cost of one pepper plant.
You must show all your working.

Tomato plant $ .....

Pepper plant $ ..... [5]

3. Nov/2022/Paper_0580_12/No.8

(a) Simplify.

$$6a+3b-2a-5b$$

..... [2]

(b) $s = 5t+\frac{1}{2}at^2$

Find the value of s when $t = 6$ and $a = 3$.

$s =$ ..... [2]

4. Nov/2022/Paper_0580_12/No.12

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

27 26 23 18 11

Find the next two terms in the sequence.

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

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

3 10 17 24 31

Find the nth term.

..... [2]

5. Nov/2022/Paper_0580_12/No.16

(a) Expand.

$x(x+8)$

..... [2]

(b) Factorise completely.

$6a-3ab$

..... [2]

(c) Solve.

$5x-6=x+3$

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

6. Nov/2022/Paper_0580_12/No.20

(a) $5^8 \div 5^x = 5^2$

Find the value of x.

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

(b) Simplify $(x^5)^3$.

..... [1]

7. Nov/2022/Paper_0580_13/No.11

(a) Expand the brackets and simplify.

(i) $3(2d-3)+4(d+1)$

..... [2]

(ii) $(x-4)(x-3)$

..... [2]

(b) Factorise $8p-3pq$.

..... [1]

8. Nov/2022/Paper_0580_13/No.13

x is an integer where $x > -4$ and $x \leqslant 2$.

Write down all the possible values of x.

..... [2]

9. Nov/2022/Paper_0580_13/No.20

Solve the simultaneous equations.

$$3x - 2y = 21$$
$$5x + 2y = 51$$

$x =$ .....

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

10. Nov/2022/Paper_0580_13/No.22

(a) $120 = 2^m \times 3 \times 5$

Find the value of m.

$m =$ ..... [1]

(b) One traffic light changes to red every 120 seconds.
Another traffic light changes to red every 144 seconds.
Both change to red at 10 00.

Find the time at which they next change to red together.

..... [3]

11. Nov/2022/Paper_0580_13/No.23

Make m the subject of the formula $q = \frac{m}{7} + r$.

$m =$ ..... [2]

12. Nov/2022/Paper_0580_21/No.8

(a) 3, 9, 27, 81, …

Write down the next term in this sequence.

..... [1]

(b) 13, 17, 21, 25, …

Find the nth term of this sequence.

..... [2]

13. Nov/2022/Paper_0580_21/No.10

Simplify $18x^{18} \div 9x^{9}$.

..... [2]

14. Nov/2022/Paper_0580_21/No.11

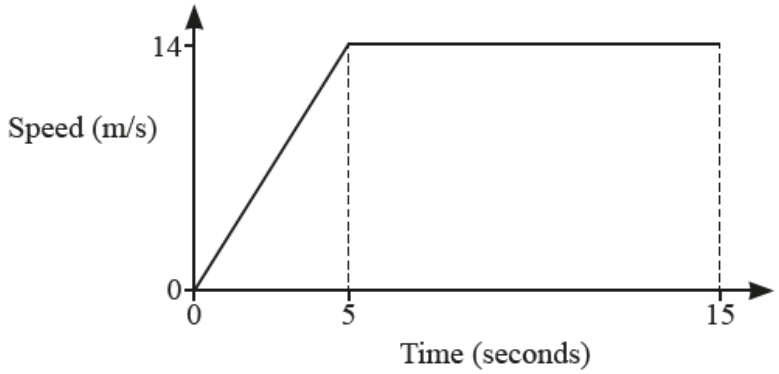
Solve the simultaneous equations.

$$x - 3y = 7$$
$$2x - 3y = 11$$

$x =$ .....

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

15. Nov/2022/Paper_0580_21/No.13



NOT TO SCALE

The diagram shows the speed–time graph of the first 15 seconds of a car journey.

(a) Find the acceleration of the car during the first 5 seconds.

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

(b) Find the distance travelled during the 15 seconds.

..... m [2]

16. Nov/2022/Paper_0580_21/No.17

Simplify $\left(3125x^{3125}\right)^{\frac{1}{5}}$.

..... [2]

17. Nov/2022/Paper_0580_21/No.19

Expand and simplify.

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

..... [3]

18. Nov/2022/Paper_0580_21/No.20

Factorise completely.

(a) $1+x-y-xy$

..... [2]

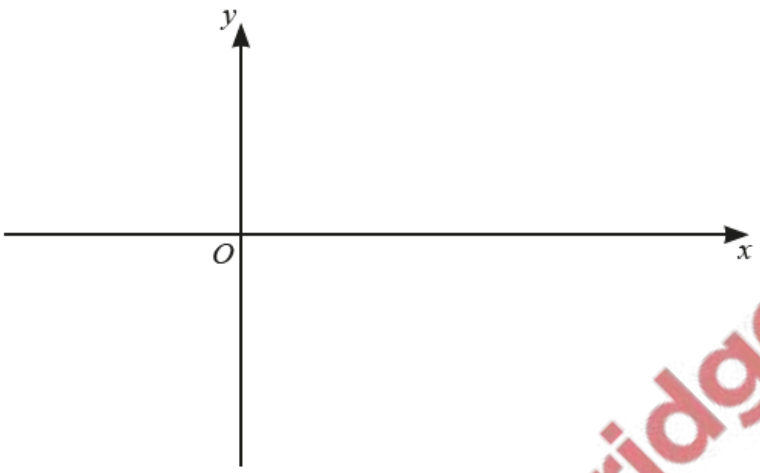
(b) $2x^3-18xy^2$

..... [3]

19. Nov/2022/Paper_0580_21/No.21

The graph of a cubic function has two turning points.
When $x < 0$ and when $x > 4$ the gradient of the graph is positive.
When $0 < x < 4$ the gradient of the graph is negative.
The graph passes through the origin.

Sketch the graph.



[2]

20. Nov/2022/Paper_0580_21/No.23

y is inversely proportional to $\sqrt{x}$ and x is directly proportional to w^2.
When $w = 12$, $y = 12$.

Find y in terms of w.

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

21. Nov/2022/Paper_0580_21/No.22

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

(b) Solve the equation $\cos x = -\frac{1}{2}$ for $0° \leqslant x \leqslant 360°$.

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

22. Nov/2022/Paper_0580_22/No.2

Simplify.

$y \times 27 - y \times 77$

..... [1]

23. Nov/2022/Paper_0580_22/No.4

Expand.

$x(3 + x^2)$

..... [2]

24. Nov/2022/Paper_0580_22/No.6

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

27 26 23 18 11

Find the next two terms in the sequence.

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

(b) The table shows information about two different sequences.

	First five terms of sequence					*n*th term
Sequence A	3	10	17	24	31	
Sequence B	2	11	26	47	74	

Complete the table.

25. Nov/2022/Paper_0580_22/No.11

The graph of $y = (x-3)(x+b)(x+2)$ intersects the y-axis at -30.

(a) Find the value of b.

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

(b) When $x > 0$ the graph crosses the x-axis once.

Write down the coordinates of this point.

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

$f(x) = x^2$ $\quad$ $g(x) = \frac{x+5}{2}$ $\quad$ $h(x) = 7x - 3$

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

..... [1]

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

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

(c) Solve $gf(x) = hh^{-1}(63)$ where $x > 0$.

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

27. Nov/2022/Paper_0580_22/No.20

Simplify fully.

(a) $(81x^{16})^{\frac{3}{4}}$

..... [2]

(b) $\left(\frac{1}{y^2}\right)^{-\frac{1}{2}}$

..... [1]

28. Nov/2022/Paper_0580_22/No.23

Solve $\frac{4}{x+1}+\frac{2}{2x-5}=3$.

You must show all your working.

$x =$ ..... or $x =$ ..... [7]

29. Nov/2022/Paper_0580_23/No.9

Solve the simultaneous equations.

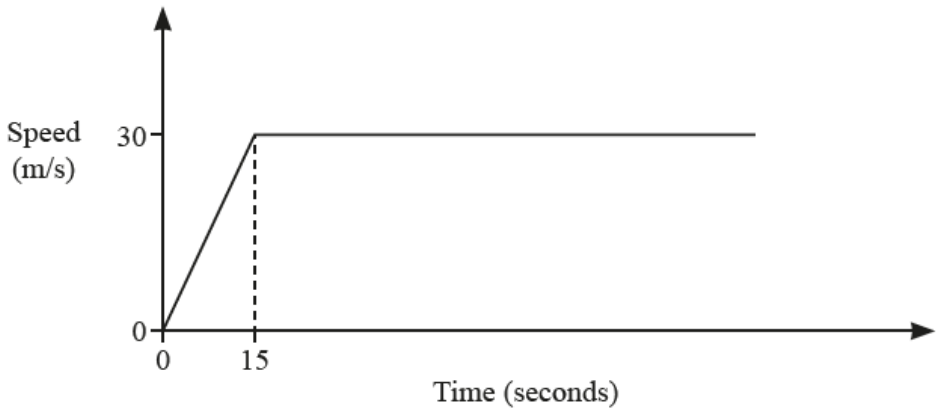
$$3x - 2y = 21$$
$$5x + 2y = 51$$

$x =$ .....

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

30. Nov/2022/Paper_0580_23/No.15

The diagram shows the speed–time graph for part of the journey of a car.



The car starts from rest and accelerates at a uniform rate for 15 seconds before reaching a constant speed of 30 m/s.

(a) Calculate the acceleration for the first 15 seconds.

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

(b) After T **minutes**, the total distance travelled is 45 **kilometres**.

Find the value of T.

$T =$ ..... min [4]

31. Nov/2022/Paper_0580_23/No.17

y is proportional to the square of $(x-7)$.
When $x = 12$, $y = 2$.

Find y when $x = 17$.

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

32. Nov/2022/Paper_0580_23/No.19

$f(x) = 5x - 3, \ x > 1$

$g(x) = \frac{10}{x-2}, \ x \neq 2$

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

..... [2]

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

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

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

..... [1]

33. Nov/2022/Paper_0580_23/No.20

(a)

Sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$. [2]

(b) Solve $3 - 2\sin x = \frac{13}{4}$ for $0° \leqslant x \leqslant 360°$.

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

34. Nov/2022/Paper_0580_23/No.22

(a) Expand and simplify.

$$(2x-1)(x+4)(x-3)$$

..... [3]

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

$$\frac{4}{2x-3} \div \frac{2x^2+14x}{2x^2+11x-21}$$

..... [4]

35. Nov/2022/Paper_0580_31/No.3(b)

(b) White paper costs w cents per sheet and pink paper costs p cents per sheet.
Miguel uses 56 sheets of white paper and 21 sheets of pink paper.

Write down an expression, in terms of w and p, for the total cost, in cents, of the paper he uses.

..... cents [2]

36. Nov/2022/Paper_0580_31/No.7

(a) Simplify.

$$5g-3h-7g+6h$$

..... [2]

(b) $j = 4k+7m$

Find the value of j when $k=-5$ and $m=6$.

$j =$ ..... [2]

(c) Factorise completely.

$$14x^3+49x$$

..... [2]

(d) Solve.

$$8(3t-9) = 108$$

$t =$ ..... [3]

(e) **(i)** $9^{24} \div 9^{w} = 9^{5}$

Find the value of w.

$w =$ ..... [1]

(ii) $4x^{2} = 256$

Find the value of x.

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

37. Nov/2022/Paper_0580_32/No.5

(a) Apples cost $\$a$ per kilogram and bananas cost $\$b$ per kilogram.
Lee buys 6 kg of apples and 8 kg of bananas.

Write down an expression, in terms of a and b, for the total cost, in dollars, of the apples and the bananas.

$ ..... [2]

(b) Cara is one year older than twice Asher's age.
Brice is 22 years older than Asher.
The total of their three ages is 167.

Find the age of each person.

Asher ..... years

Brice ..... years

Cara ..... years [4]

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

$$3x + 2y = 21$$
$$2x - 5y = 33$$

$x =$ .....

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

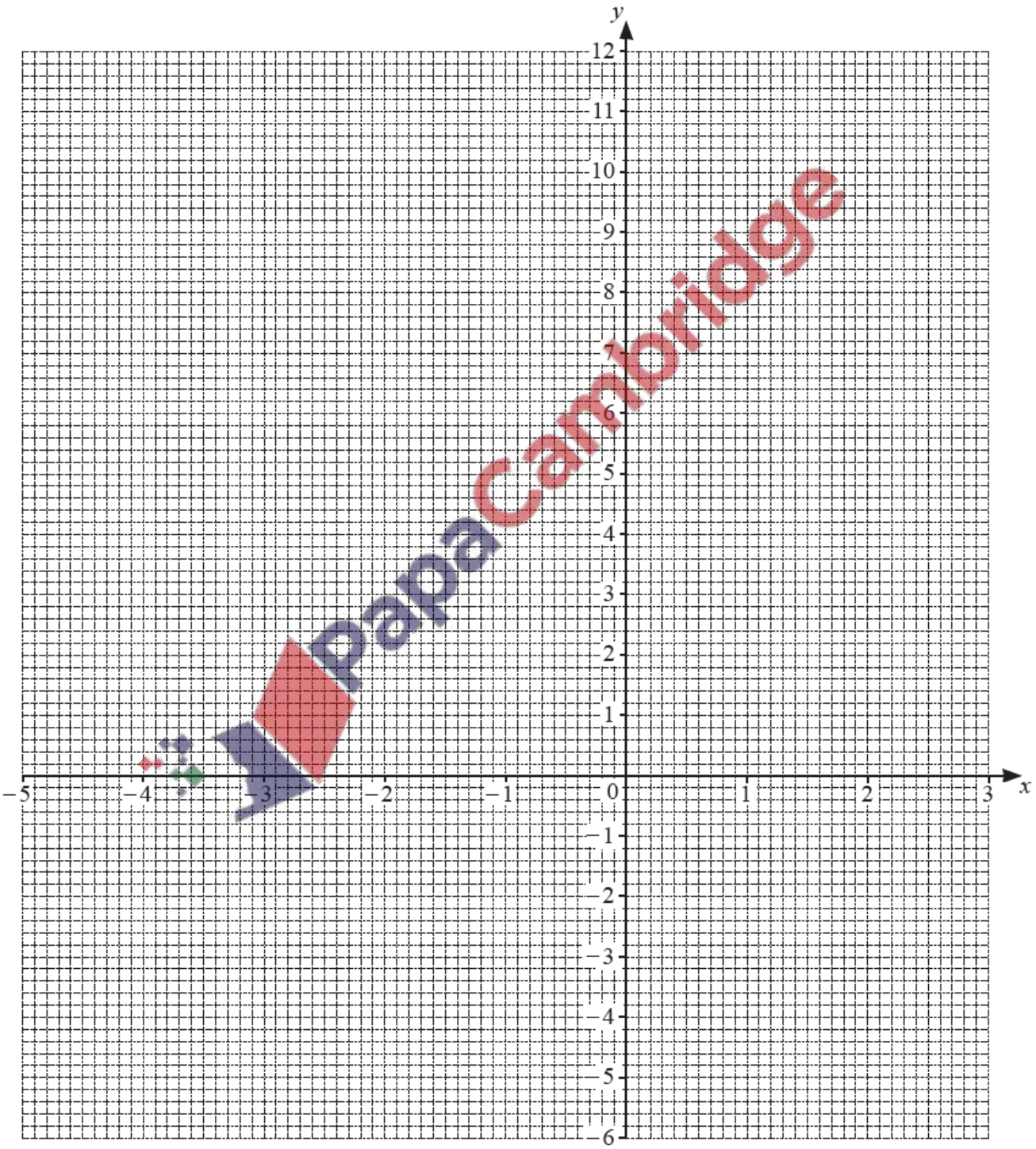
38. Nov/2022/Paper_0580_32/No.8

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

x	−5	−4	−3	−2	−1	0	1	2	3
y	11		−1				−1		11

[3]

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



[4]

(iii) Write down the equation of the line of symmetry of the graph.

..... [1]

(iv) Use your graph to solve the equation $x^2 + 2x - 4 = 0$.

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

(b) A line L has an equation of $y = 5x + 7$.

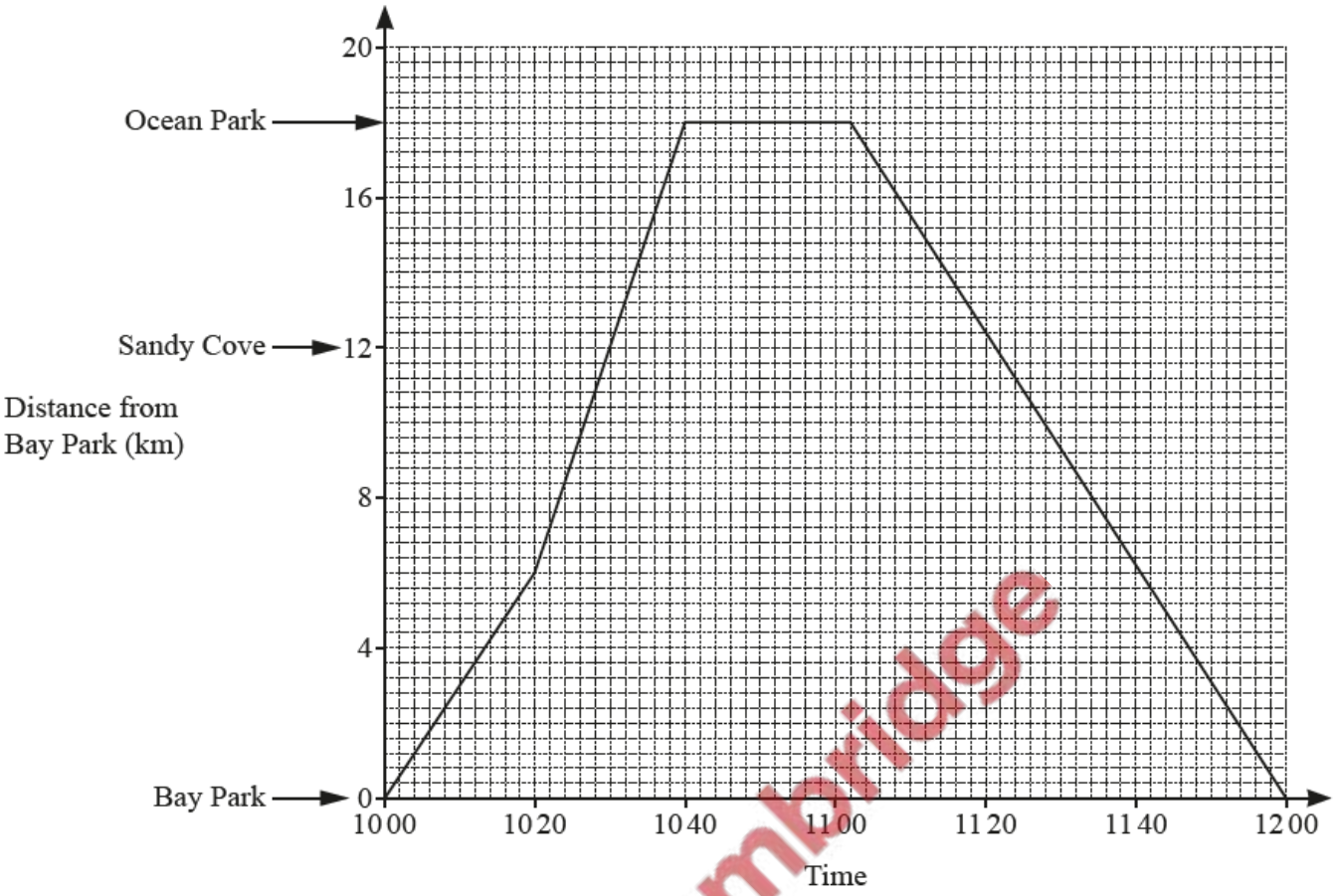
Write down the equation of the line parallel to L that passes through $(0, -2)$.

..... [2]

39. Nov/2022/Paper_0580_33/No.4

A path from Bay Park to Ocean Park passes through Sandy Cove.

(a) Tia cycles along the path.
The diagram shows the travel graph of Tia's journey.



(i) Between which two times is Tia cycling the fastest?

..... and ..... [1]

(ii) Andy leaves Bay Park at 10 20 and runs to Sandy Cove at a constant speed of 8 km/h. He then stops to rest until 12 00.

On the travel graph, draw Andy's journey.

[2]

(iii) Write down the time and the distance from Bay Park when Tia and Andy pass each other.

Time .....

Distance ..... km [2]

(b) In June, the number of cyclists using the path is 3546.
In July, the number of cyclists using the path is 4067.

Work out the percentage increase in the number of cyclists from June to July.

..... % [2]

(c) In one week, 432 walkers and 528 runners use the path.

(i) Write the ratio walkers : runners in its simplest form.

..... : ..... [1]

(ii) In the same week, the ratio of cyclists and walkers using the path is

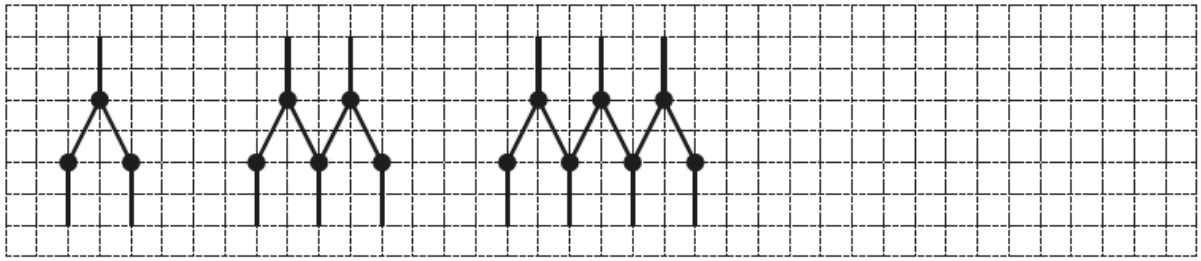
cyclists : walkers = 14 : 3.

Find the total of the number of cyclists, walkers and runners using the path in this week.

..... [3]

40. Nov/2022/Paper_0580_33/No.10

Meena makes these patterns using dots and lines.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

(a) Draw Pattern 4. [1]

(b) Complete the table.

Pattern	1	2	3	4
Number of dots	3	5	7	
Number of lines	5	9	13	

[2]

(c) **(i)** Write down the term to term rule for continuing the sequence for the number of dots.

..... [1]

(ii) Find an expression, in terms of n, for the number of dots in Pattern n.

..... [2]

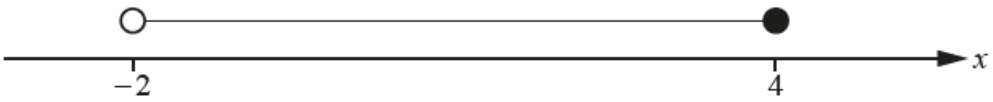
(d) The number of lines in Pattern n is $4n+1$.
Meena makes the pattern which has 129 lines.

Work out the number of dots she uses to make this pattern.

..... [4]

41. Nov/2022/Paper_0580_41/No.3

(a)



Write down the inequality shown by the number line.

..... [1]

(b) $-3 \leqslant 2x+3 < 9$

(i) Solve the inequality.

..... [3]

(ii) Write down all the integer values of x that satisfy the inequality.

..... [2]

(c) Solve the equations.

(i) $3(3-x) - \frac{2(x+2)}{5} = 1$

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

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

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

42. Nov/2022/Paper_0580_41/No.7

$f(x) = 10 - x$ $\quad g(x) = \frac{2}{x},\ x \neq 0$ $\quad h(x) = 2^x$ $\quad j(x) = 5 - 2x$

(a) (i) Find $g\left(\frac{1}{2}\right)$.

..... [1]

(ii) Find $hg\left(\frac{1}{2}\right)$.

..... [1]

(b) Find x when $f(x) = 7$.

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

(c) Find x when $g(x) = h(3)$.

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

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

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

(e) Write $f(x) + g(x) + 1$ as a single fraction in its simplest form.

..... [3]

(f) $\left(\mathrm{f}(x)\right)^2 - \mathrm{ff}(x) = ax^2 + bx + c$

Find the values of a, b and c.

$a =$ .....

$b =$ .....

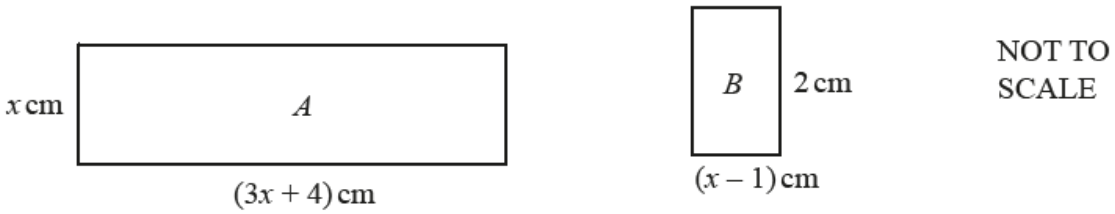
$c =$ ..... [4]

(g) Find x when $\mathrm{h}^{-1}(x) = 10$.

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

43. Nov/2022/Paper_0580_41/No.9

(a)



The total of the areas of rectangles A and B is $20\,\text{cm}^2$.

(i) Show that $3x^2 + 6x - 22 = 0$.

[2]

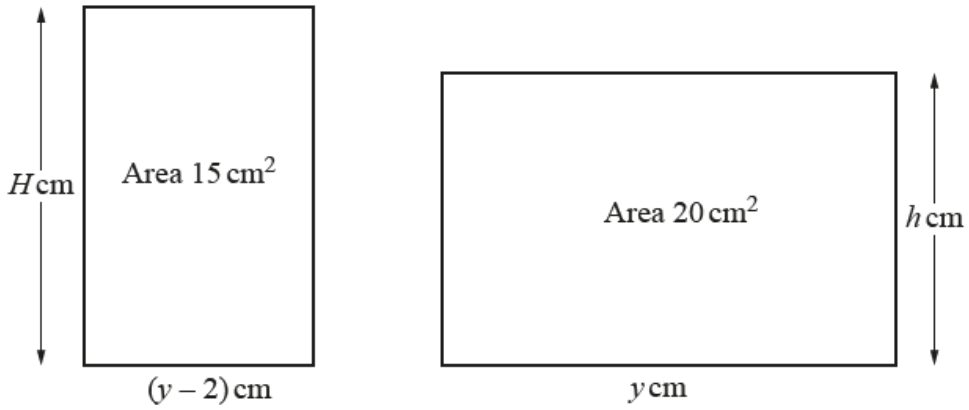
(ii) Solve the equation $3x^2 + 6x - 22 = 0$, giving your answers correct to 4 significant figures. You must show all your working.

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

(iii) Find the perimeter of rectangle B.

..... cm [1]

(b)



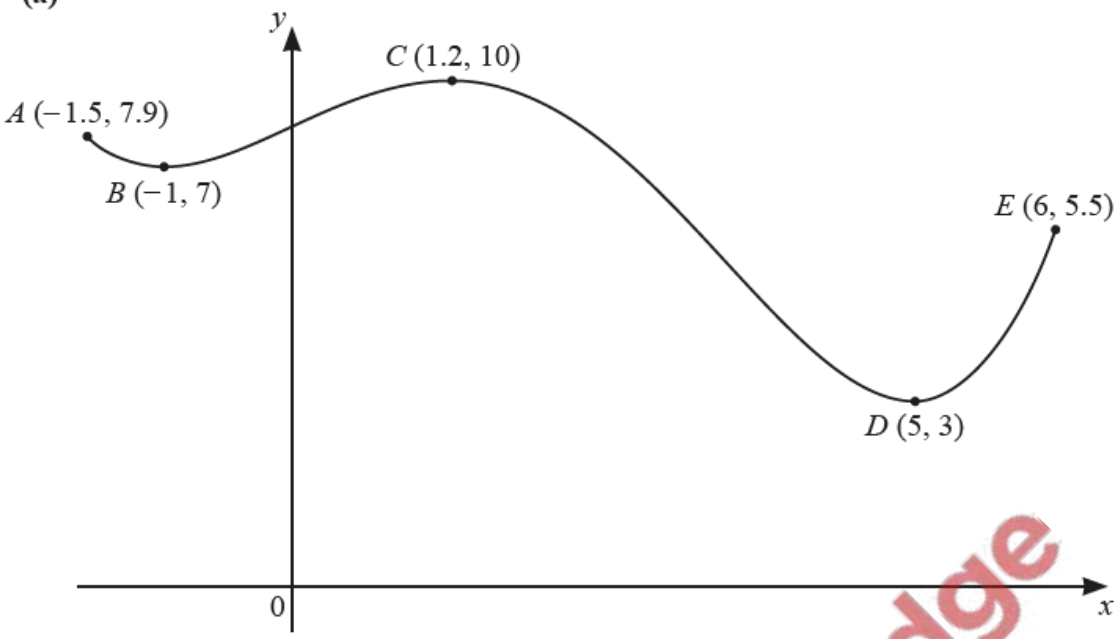
The diagram shows two rectangles where $H - h = 1$.

By forming a quadratic equation and factorising, find the value of y.

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

44. Nov/2022/Paper_0580_41/No.10

(a)



NOT TO SCALE

The diagram shows a sketch of the graph of $y = f(x)$ for $-1.5 \leqslant x \leqslant 6$.
The coordinates of five points on the graph of $y = f(x)$ are shown on the diagram.

(i) $f(x) = k$ has two solutions in the interval $-1.5 \leqslant x \leqslant 6$.

Write down a possible integer value of k.

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

(ii) $f(x) = j$ has no solutions in the interval $-1.5 \leqslant x \leqslant 6$ when $j < a$ or $j > b$.

Find the maximum value of a and the minimum value of b.

$a =$ .....

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

(b) Find the coordinates of the two stationary points on the graph of $y = x^6 - 6x^5$.
You must show all your working.

(..... , ...)

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

45. Nov/2022/Paper_0580_42/No.1(b)

(b) Another club sells season tickets for individuals and for families.
In 2018, the number of season tickets sold is in the ratio family : individual = 2 : 7.

(i) The number of family season tickets sold is x.

Write an expression, in terms of x, for the number of individual season tickets sold.

..... [1]

(ii) In 2019, the number of family season tickets sold increases by 12 and the number of individual season tickets sold decreases by 26.

Complete the table by writing expressions, in terms of x, for the number of tickets sold each year.

Year	Family tickets	Individual tickets
2018	x	
2019		

[2]

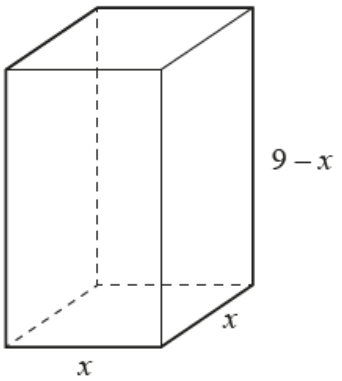
(iii) In 2019, the number of individual season tickets sold is 3 times the number of family season tickets sold.

Write an equation in x and solve it to find the number of family tickets sold in 2018.

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

46. Nov/2022/Paper_0580_42/No.2

All the lengths in this question are measured in centimetres.



NOT TO SCALE

The diagram shows a solid cuboid with a square base.

(a) The volume, $V\,\text{cm}^3$, of the cuboid is $V = x^2(9-x)$.
The table shows some values of V for $0 \leqslant x \leqslant 9$.

x	0	1	2	3	4	5	6	7	8	9
V	0	8		54	80	100	108	98	64	0

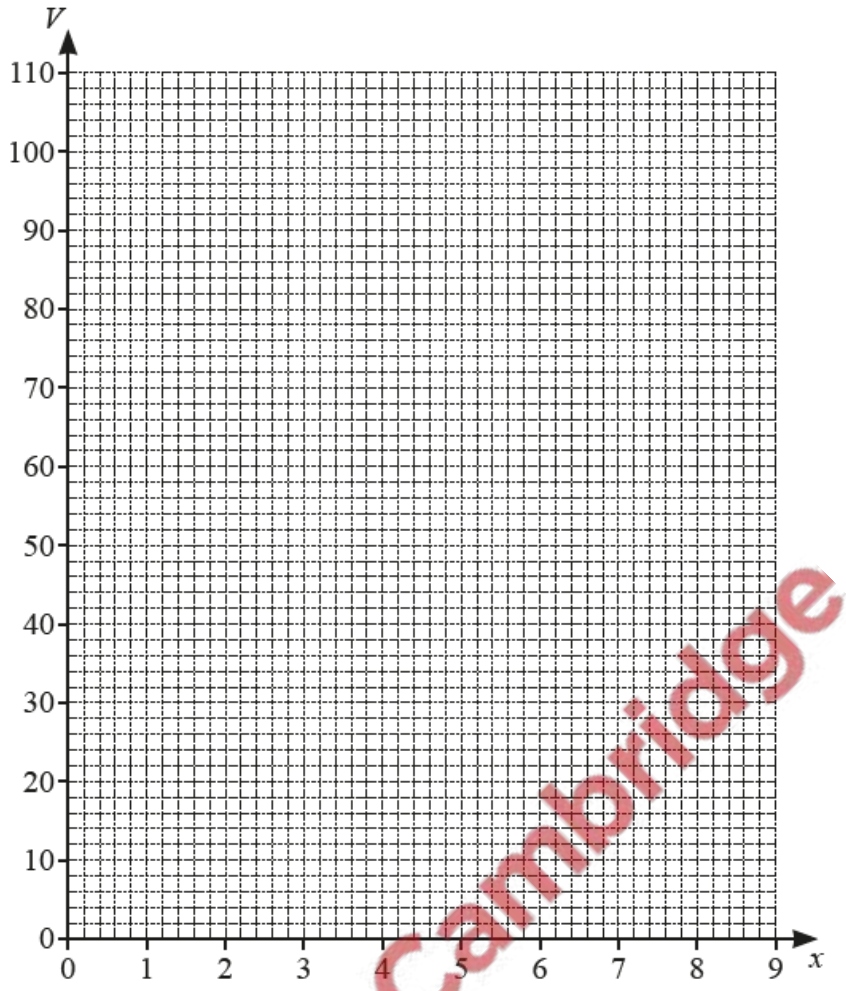
(i) Complete the table.

[1]

(ii) On the grid on the opposite page, draw the graph of $V = x^2(9-x)$ for $0 \leqslant x \leqslant 9$. [4]

(iii) Find the values of x when the volume of the cuboid is $44\,\text{cm}^3$.

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



(b) **(i)** Show that the total surface area of the cuboid is $(36x - 2x^2)\,\text{cm}^2$.

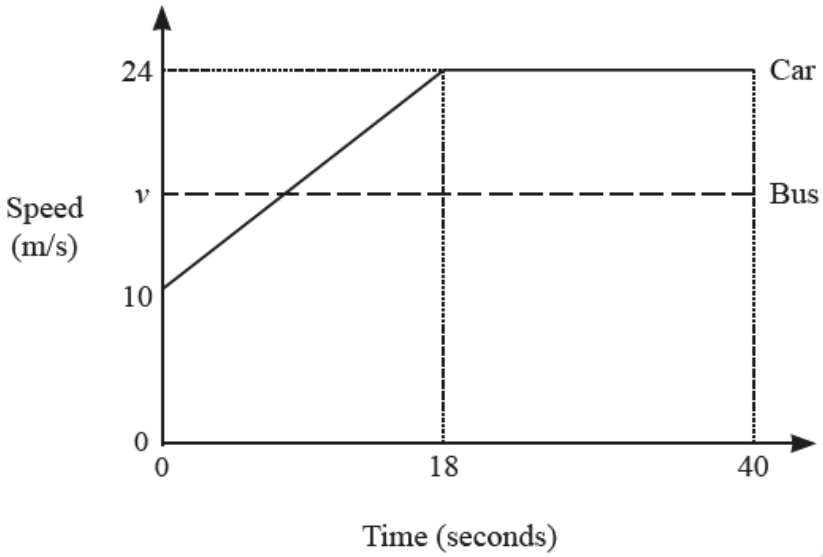
[2]

(ii) Find the surface area when the volume of the cuboid is a maximum.

..... cm^2 [3]

47. Nov/2022/Paper_0580_42/No.5

(a) The diagram shows the speed–time graph for part of a journey for two vehicles, a car and a bus.



NOT TO SCALE

(i) Calculate the acceleration of the car during the first 18 seconds.

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

(ii) In the first 40 seconds the car travelled 134 m more than the bus.

Calculate the constant speed, v, of the bus.

v = ... m/s [4]

(b) A train takes 10 minutes 30 seconds to travel 16 240 m.

Calculate the average speed of the train.
Give your answer in kilometres per hour.

..... km/h [3]

48. Nov/2022/Paper_0580_42/No.6

(a) Solve.

$$4x+15=9$$

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

(b) Factorise.

$$a^2-9$$

..... [1]

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

$$\frac{4a}{5} \div \frac{3ad}{10c}$$

..... [3]

(d) $5^n+5^n+5^n+5^n+5^n=5^m$

Find an expression for m in terms of n.

$m =$ ..... [2]

(e) Solve by factorisation.

$$4x^2+8x-5=0$$

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

(f) **(i)** y is directly proportional to $(x+3)^3$.
When $x = 2$, $y = 13.5$.

Find x when $y = 108$.

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

(ii) g is inversely proportional to the square of d.
When d is halved, the value of g is multiplied by a factor n.

Find n.

$n =$ ..... [2]

(g) Expand and simplify.

$$(2x+3)(x-1)(x+3)$$

..... [3]

(h) Find the derivative, $\frac{dy}{dx}$, of $y = 3x^2 + 4x - 1$.

..... [2]

49. Nov/2022/Paper_0580_42/No.9

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

(b) Solve the equation $5\sin x + 4 = 0$ for $0° \leqslant x \leqslant 360°$.

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

50. Nov/2022/Paper_0580_43/No.2

(a) Simplify fully.

(i) $p^3 \times p^{11}$

..... [1]

(ii) $\dfrac{18m^6}{3m^2}$

..... [2]

(iii) $\left(\dfrac{27x^9y^{27}}{64}\right)^{-\frac{1}{3}}$

..... [3]

(b) A sequence has nth term $3n^2$.

Write down the first 3 terms of this sequence.

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

(c) Find the nth term for each of these sequences.

(i) 13, 16, 19, 22, 25, …

..... [2]

(ii) 3, 17, 55, 129, 251, …

..... [2]

(d) Solve.

$$\frac{3x-22}{4} = 23$$

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

(e) Use the quadratic formula to solve $3x^2 + 8x - 20 = 0$.
Show all your working and give your answers correct to 2 decimal places.

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

51. Nov/2022/Paper_0580_43/No.6

(a) $P = 5k^2 - 7$

(i) Find the value of P when $k = 3$.

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

(ii) Rearrange the formula to make k the subject.

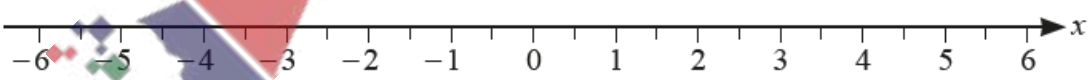
$k =$ ..... [3]

(b) **(i)** Solve.

$$x - 3 \leqslant 5x + 7$$

..... [2]

(ii) Show your answer to **part (b)(i)** on the number line.



[1]

(f) **(i)** y is directly proportional to $(x+3)^3$.
When $x = 2$, $y = 13.5$.

Find x when $y = 108$.

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

(ii) g is inversely proportional to the square of d.
When d is halved, the value of g is multiplied by a factor n.

Find n.

$n =$ ..... [2]

(g) Expand and simplify.

$$(2x+3)(x-1)(x+3)$$

..... [3]

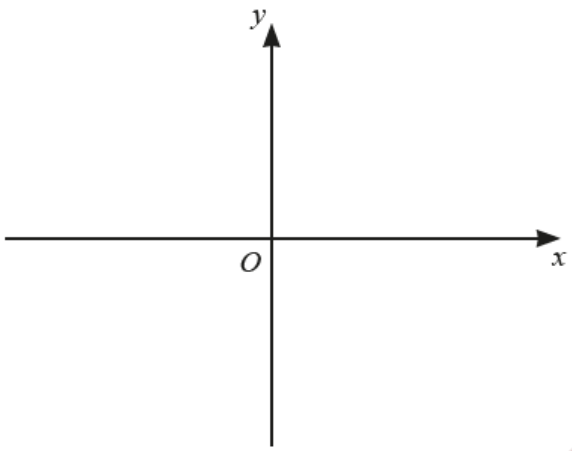
(h) Find the derivative, $\frac{dy}{dx}$, of $y = 3x^2 + 4x - 1$.

..... [2]

52. Nov/2022/Paper_0580_43/No.9

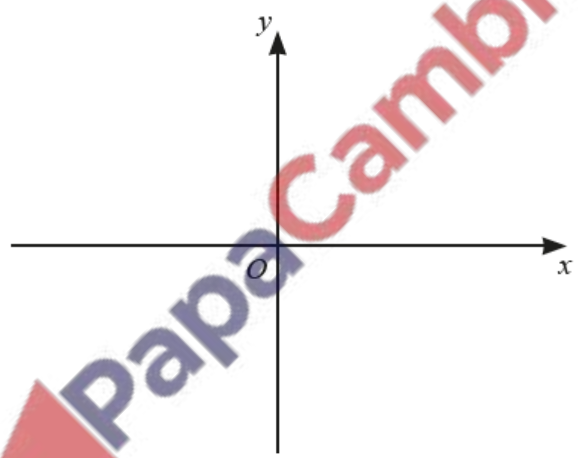
(a) Sketch the following graphs.
On each sketch, indicate any intercepts with the axes.

(i) $3x - 4y = 12$



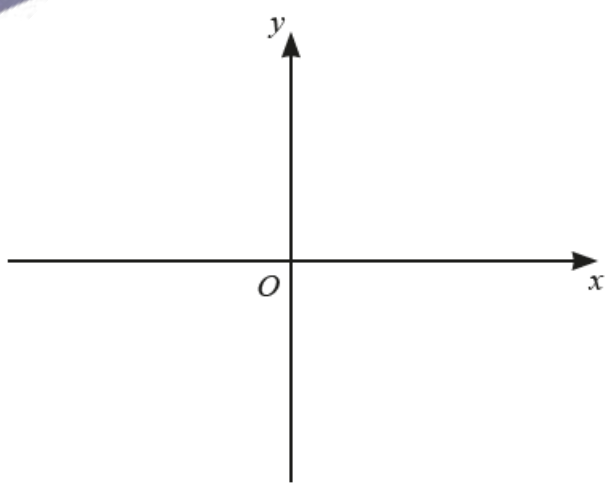
[2]

(ii) $y = x^2 - 3x - 4$



[4]

(iii) $y = 6^x$



[2]

(b) **(i)** Find the derivative, $\frac{dy}{dx}$, of $y = 5 + 8x - \frac{4}{3}x^3$.

..... [2]

(ii) Find the gradient of $y = 5 + 8x - \frac{4}{3}x^3$ at $x = -1$.

..... [2]

(iii) A tangent is drawn to the graph of $y = 5 + 8x - \frac{4}{3}x^3$.

The gradient of the tangent is -28.

Find the coordinates of the two possible points where this tangent meets the graph.

(..... , ...)

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