Algebra and graphs – 2023 Nov IGCSE 0580

1. Nov/2023/Paper_0580/11/No.3, 0580/13/No.3

Complete these statements.

(a) When $x =$ ..... , $x+3 = 8$.

[1]

(b) When $7y = 63$, $10y =$ .....

[1]

2. Nov/2023/Paper_0580/11/No.14

Factorise completely.

$42mk - 35m$

..... [2]

3. Nov/2023/Paper_0580/11/No.16

Simplify.

(a) $n^5 \times n$

..... [1]

(b) $8x^6 \div 2x^2$

..... [2]

4. Nov/2023/Paper_0580/12/No.3

These are the first four terms in a sequence.

$-3 \quad 4 \quad 11 \quad 18$

(a) Find the next term.

..... [1]

(b) Explain how you worked out your answer.

..... [1]

5. Nov/2023/Paper_0580/12/No.9, 0580/22/No.3

$v = u + at$

Find the value of v when $u = 30$, $a = -2$ and $t = 7$.

$v =$ ..... [2]

6. Nov/2023/Paper_0580/12/No.18

Expand and simplify.

$$2(t+w)+3(w-t)$$

..... [2]

7. Nov/2023/Paper_0580/13/No.11

Factorise completely.

$$15v^2 - 3v$$

..... [2]

8. Nov/2023/Paper_0580/13/No.16

Solve the equation.

$$5x + 7 = 9x - 3$$

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

9. Nov/2023/Paper_0580/13/No.18

A bar of chocolate costs $3 and a bag of sweets costs $5.

Write down an expression for the total cost, in dollars, of x bars of chocolate and y bags of sweets.

$ ..... [2]

10. Nov/2023/Paper_0580/13/No.23

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

$$3x + 5y = 23$$
$$6x - 4y = 11$$

$x =$ .....

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

11. Nov/2023/Paper_0580/21/No.5

Factorise completely.

(a) $42mk - 35m$

..... [2]

(b) $h^2 - 144$

..... [1]

12. Nov/2023/Paper_0580/21/No.10

Simplify.

(a) $n^5 \times n$

..... [1]

(b) $8x^6 \div 2x^2$

..... [2]

(c) $(243y^{20})^{\frac{2}{5}}$

..... [2]

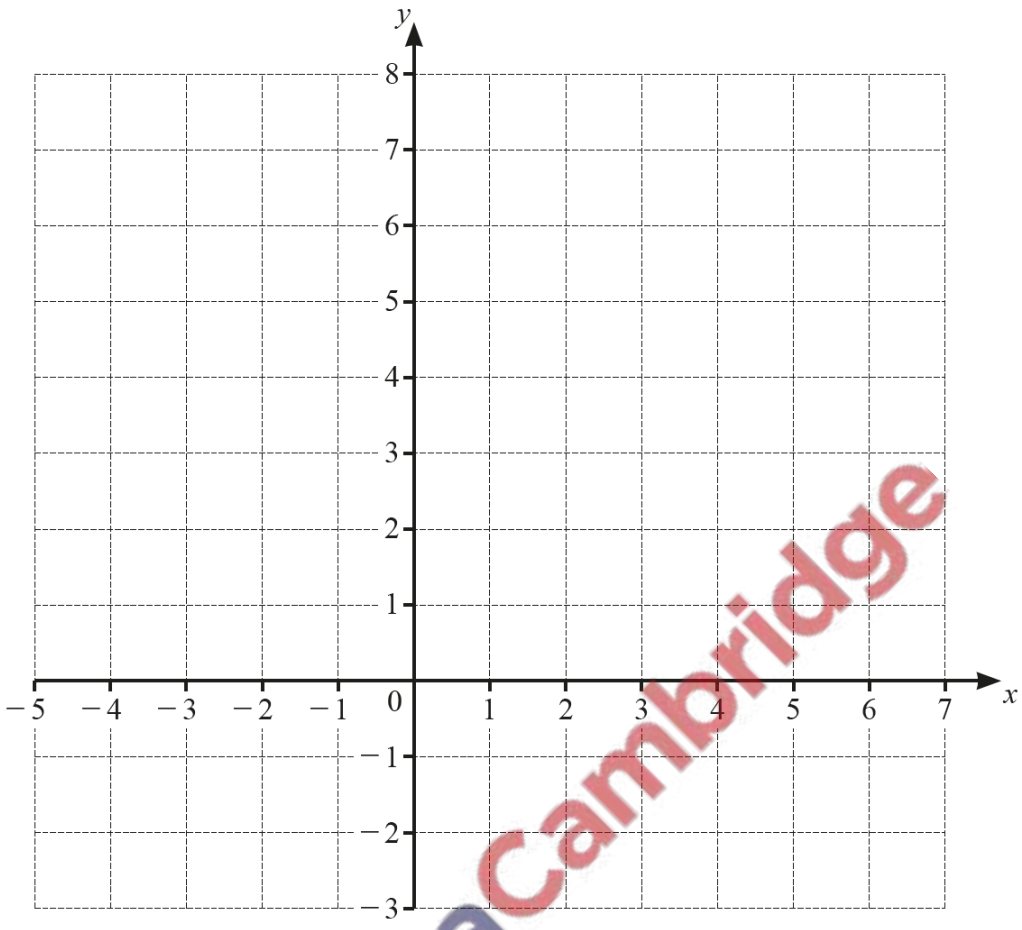
13. Nov/2023/Paper_0580/21/No.11

Solve.

$$4(2x-3) \geqslant 43+3x$$

..... [3]

14. Nov/2023/Paper_0580/21/No.15



By shading the **unwanted** regions of the grid, draw and label the region R which satisfies these inequalities.

$y > 1$ $x \leqslant 2$ $y \geqslant x+2$

[5]

15. Nov/2023/Paper_0580/21/No.16

$P = 2w + 2h$

$w = 11$ and $h = 9.5$, both correct to 2 significant figures.

Find the lower bound and the upper bound for P.

Lower bound = ...

Upper bound = ... [3]

16. Nov/2023/Paper_0580/21/No.20

Write as a single fraction in its simplest form.

(a) $\dfrac{10x^2 - 60x}{x^2 - x - 30}$

..... [3]

(b) $\dfrac{7}{x+3} + \dfrac{5}{8x-1}$

..... [3]

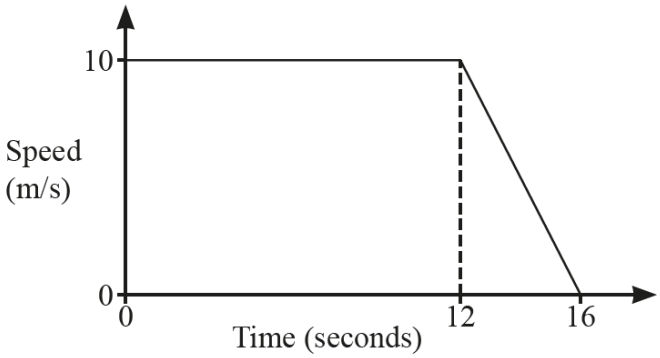
17. Nov/2023/Paper_0580/22/No.10

Expand and simplify.

$$2(t+w)+3(w-t)$$

..... [2]

18. Nov/2023/Paper_0580/22/No.12



NOT TO
SCALE

The diagram shows a speed–time graph for 16 seconds of a car journey.

(a) Find the deceleration of the car in the final 4 seconds.

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

(b) Find the total distance travelled during the 16 seconds.

..... m [2]

19. Nov/2023/Paper_0580/22/No.13

(a) $3^{3p} \times 3^{2p} = 729$

Find the value of p.

$p =$ ..... [2]

(b) Simplify.

$$(32x^{10})^{\frac{1}{5}}$$

..... [2]

20. Nov/2023/Paper_0580/22/No.14

$y = 2w^2 - x$

Rearrange the formula to make w the subject.

$w =$ ..... [3]

21. Nov/2023/Paper_0580/22/No.19

Find the nth term of each sequence.

(a) 11, 8, 5, 2, −1, …

..... [2]

(b) 1, 5, 25, 125, 625, …

..... [2]

22. Nov/2023/Paper_0580/22/No.22

x is inversely proportional to the square root of w.
When $w = 16$, $x = 3$.

Find x in terms of w.

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

23. Nov/2023/Paper_0580/22/No.24

Simplify.

$$\frac{ax-2a-x+2}{a^2-1}$$

..... [4]

24. Nov/2023/Paper_0580/22/No.25

The derivative of $2ax^7 + 3x^k$ is $42x^6 + 15x^{k-1}$.

Find the value of a and the value of k.

$a =$ .....

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

25. Nov/2023/Paper_0580/23/No.9

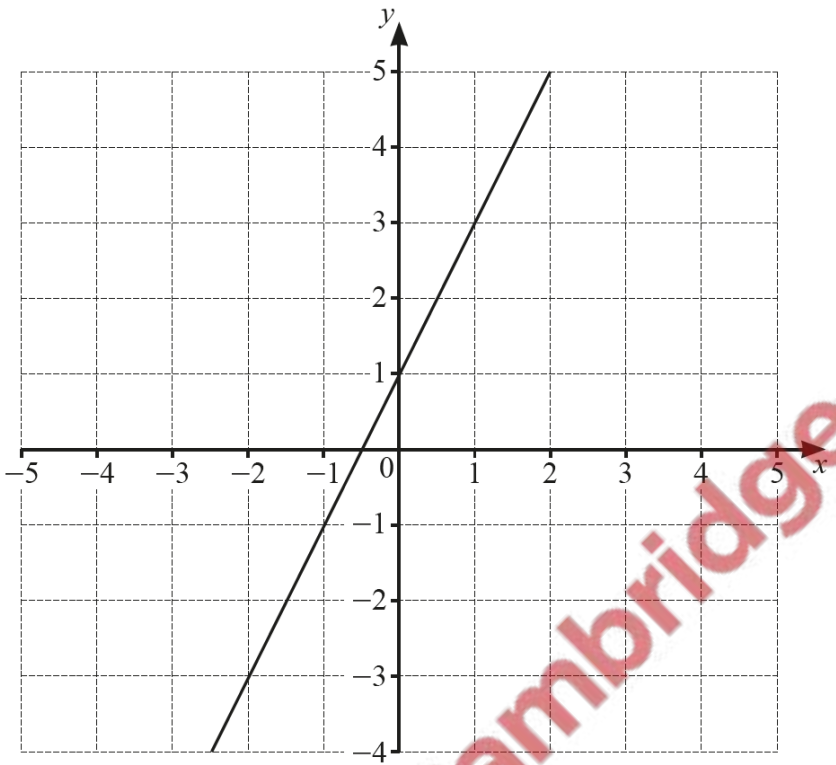
$$P = \frac{2wy^2}{3}$$

Find the positive value of y when $P = 108$ and $w = 8$.

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

26. Nov/2023/Paper_0580/23/No.13

The graph of $y = 2x + 1$ is drawn on the grid.



By shading the **unwanted** regions of the grid, find and label the region R which satisfies these inequalities.

$y \geqslant 2x + 1$ $y \geqslant 1$ $4x + 3y < 12$ [4]

27. Nov/2023/Paper_0580/23/No.15

$T = \sqrt{3d - e}$

Rearrange the formula to make d the subject.

$d =$ ..... [3]

28. Nov/2023/Paper_0580/23/No.17

(a) Simplify.

$$\left(64y^{27}\right)^{\frac{2}{3}}$$

..... [2]

(b) Simplify.

$$\frac{x-5}{x^2-25}$$

..... [2]

29. Nov/2023/Paper_0580/23/No.20

$(x+a)(x+2)(2x+3)$ is equivalent to $2x^3+bx^2+cx-18$.

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

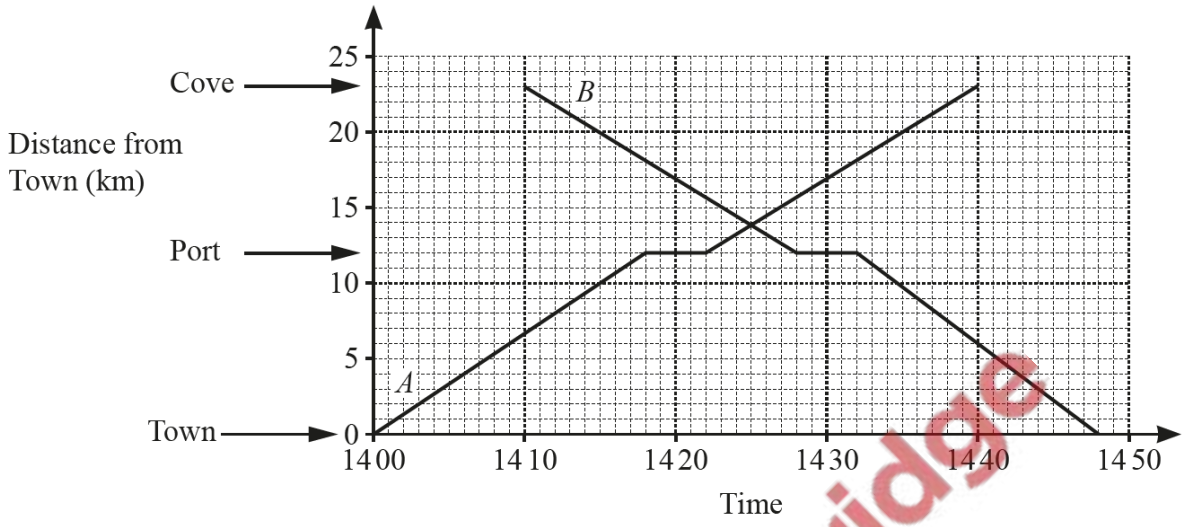
$a =$ .....

$b =$ .....

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

30. Nov/2023/Paper_0580/31/No.5

A railway line has three stations, Town, Port and Cove.
Train *A* leaves Town for Cove and train *B* leaves Cove for Town.
Both trains stop at Port.



(a) Write down the time that train *B* leaves Cove.

..... [1]

(b) Write down how long train *A* stops at Port.

..... min [1]

(c) How many more minutes does train *A* take to complete the whole journey than train *B*?

..... min [2]

(d) Write down the time that the two trains pass each other.

..... [1]

(e) Work out the average speed of train *A* between Town and Cove in kilometres per hour.

..... km/h [3]

31. Nov/2023/Paper_0580/31/No.7

(a) Simplify.

$5a+3b+2a-4b$

..... [2]

(b) $P = 8x+3y$

Find the value of x when $P = 21$ and $y = -5$.

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

(c) Make v the subject of the formula $S = kv^2$.

$v =$ ..... [2]

(d) Multiply out and simplify.

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

..... [2]

(e) Nasser has x marbles.
Selina has 15 more marbles than Nasser.
Hanif has 3 times as many marbles as Selina.
In total they have 150 marbles.

Find the value of x.

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

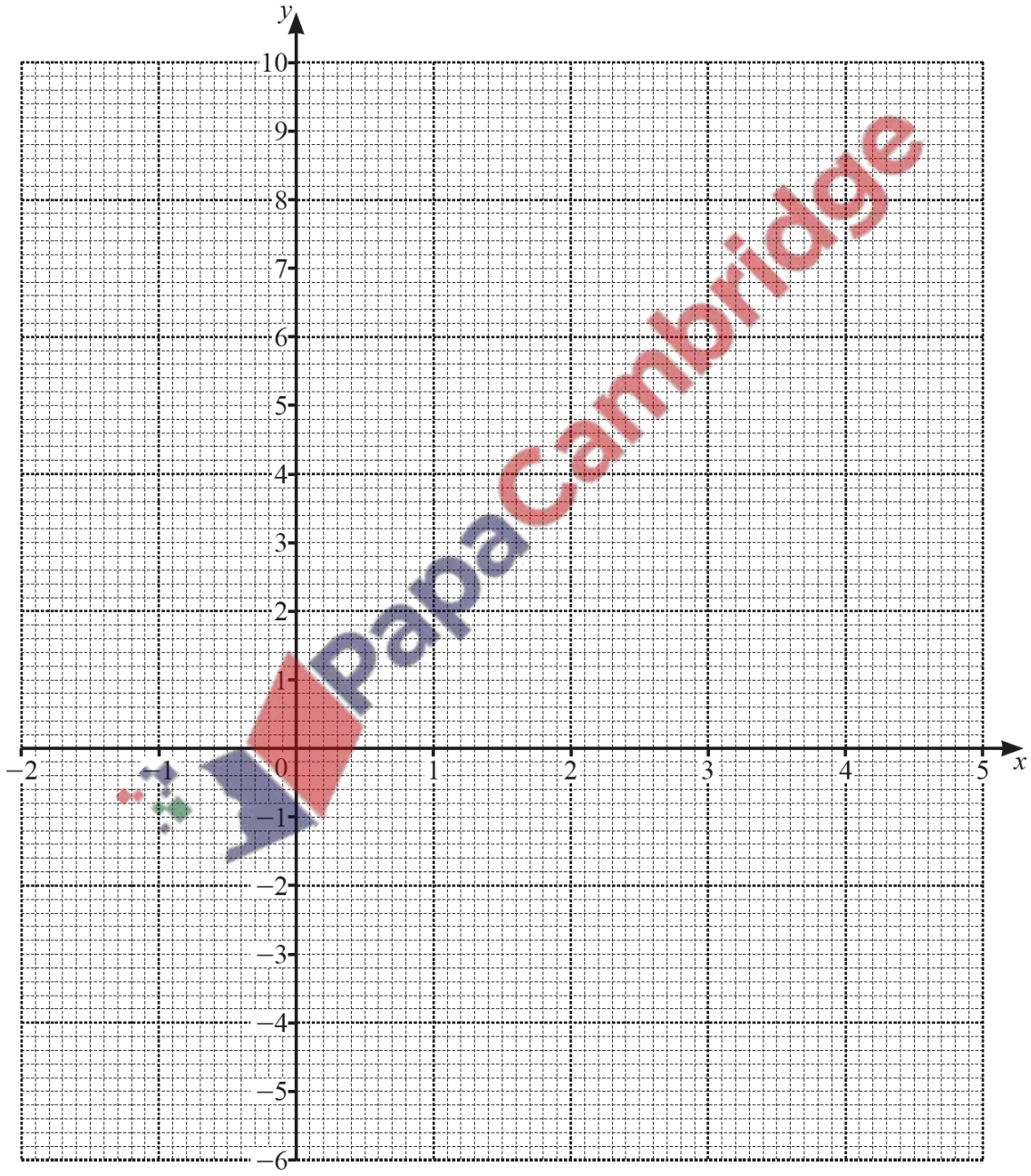
32. Nov/2023/Paper_0580/32/No.4

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

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

[2]

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



[4]

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

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

33. Nov/2023/Paper_0580/32/No.6

(a) Simplify.

$a+4a-3a$

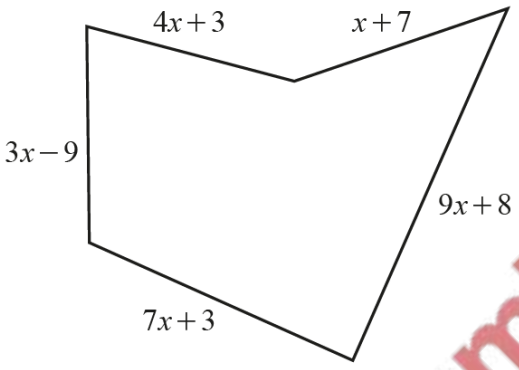
..... [1]

(b) Simplify.

$8b-4\times 7b$

..... [1]

(c)



The perimeter of this shape is equal to the perimeter of a square.

Find an expression for the length of one side of the square.
Give your answer in its simplest form.

..... [4]

(d) Victoria buys 5 cups of tea and 4 cakes for $15.69 .
Isabella buys 3 cups of tea and 7 cakes for $17.97 .

Write down a pair of simultaneous equations and solve them to find the cost of one cup of tea and the cost of one cake.
You must show all your working.

Tea $ .....

Cake $ ..... [6]

34. Nov/2023/Paper_0580/33/No.7

These are the first four diagrams in a sequence.
The diagrams are made using dots and lines.

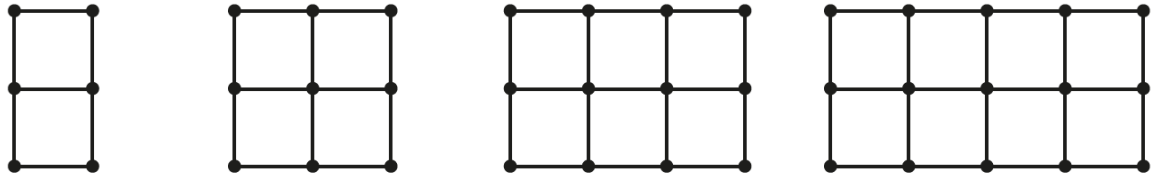


Diagram 1 Diagram 2 Diagram 3 Diagram 4

(a) Complete the table.

Diagram	1	2	3	4
Number of small squares	2	4	6	
Number of dots	6	9	12	
Number of lines	7	12	17	

[2]

(b) Complete this statement.

A diagram in this sequence cannot have 51 small squares because .....

..... [1]

(c) An expression for the number of dots in Diagram n is $3n+3$.

Which diagram has 249 dots?

..... [2]

(d) **(i)** Find an expression, in terms of n, for the number of lines in Diagram n.

..... [2]

(ii) Find the number of lines in Diagram 41.

..... [1]

35. Nov/2023/Paper_0580/33/No.8

(a) Expand and simplify.

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

..... [2]

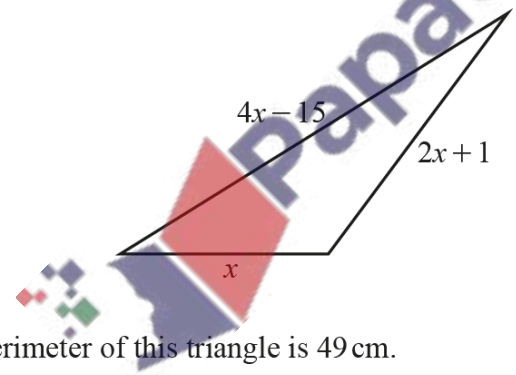
(ii) $(m-6)(m-4)$

..... [2]

(b) Make t the subject of the formula $p = 4t+3$.

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

(c) In this part, all measurements are in centimetres.



NOT TO SCALE

The perimeter of this triangle is 49 cm.

Work out the value of x.

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

36. Nov/2023/Paper_0580/41/No.2

(a) $s = \frac{1}{2}at^2$

Find the value of s when $a = 9.8$ and $t = 20$.

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

(b) Solve.

$5(4y - 3) = 15$

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

(c) Expand and simplify.

$3(5x - 8) - 2(3x - 7)$

..... [2]

(d) Rearrange $A = 2b^2 - 3c^3$ to make c the subject.

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

(e) Factorise completely.

$6pq - 4q - 3p + 2$

..... [2]

37. Nov/2023/Paper_0580/41/No.6

(a)

Sequence	1st term	2nd term	3rd term	4th term	5th term		nth term
A	-7	-3	1	5			
B	7	13	23	37			
C	$\frac{2}{27}$	$\frac{3}{81}$	$\frac{4}{243}$	$\frac{5}{729}$			

Complete the table for the three sequences.

[10]

(b) In a sequence, the sum of the first 49 terms is 7644.
The sum of the first 50 terms is 7975.

Find the 50th term of this sequence.

..... [1]

38. Nov/2023/Paper_0580/41/No.9

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

(a) Find

(i) $f(0)$

..... [1]

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

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

(iii) $gh(2)$.

..... [2]

(b) $g(2x) = 7$

Find the value of x.

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

(c) Simplify $g(x^2) + gg(x) + 1$.

..... [3]

(d) Find $h^{-1}(16)$.

..... [2]

(e) $f(x) = (3x+1)(x+5)(x-4)$

This can be written in the form $f(x) = ax^3 + bx^2 + cx + d$.

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

a = ... b = ... c = ... d = ... [3]

39. Nov/2023/Paper_0580/41/No.11

(a) Differentiate $x^3 - 4x^2 - 3x$.

..... [2]

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

Work out the coordinates of the two stationary points.
Show all your working.

(..... , ...)

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

(c) Determine whether each stationary point is a maximum or a minimum.
Show all your working.

[3]

40. Nov/2023/Paper_0580/42/No.5

(a) In a shop the cost of a fiction book is $\$x$ and the cost of a reference book is $\$(x+2)$.
The cost of 11 fiction books is the same as the cost of 10 reference books.

Find the value of x.

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

(b) In another shop, the cost of a fiction book is $\$y$ and the cost of a reference book is $\$(y+2)$.
Maria spends \$95 on fiction books and \$147 on reference books.
She buys a total of 12 books.

(i) Show that $6y^2 - 109y - 95 = 0$.

[4]

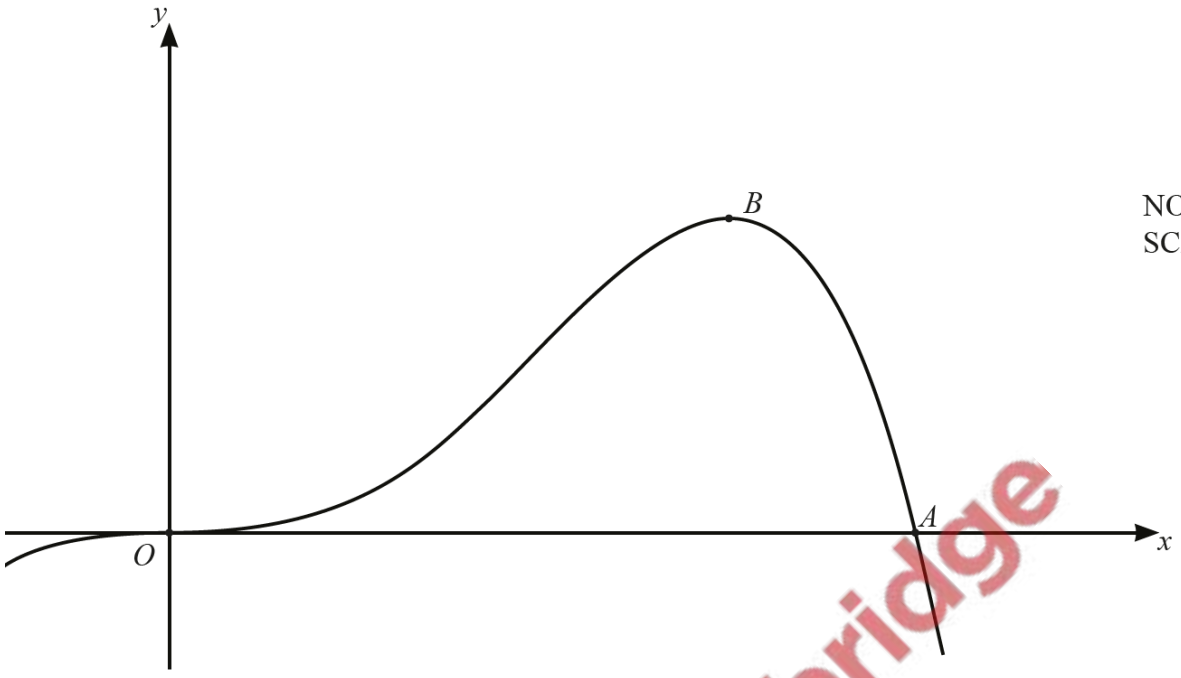
(ii) Factorise $6y^2 - 109y - 95$.

..... [2]

(iii) Find the value of y.

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

41. Nov/2023/Paper_0580/42/No.9



NOT TO SCALE

The diagram shows a sketch of the graph of $y = 4x^3 - x^4$.
The graph crosses the x-axis at the origin O and at the point A.
The point B is a maximum point.

(a) Differentiate $4x^3 - x^4$.

..... [2]

(b) Find the coordinates of B.

(..... , ...) [3]

(c) Find the gradient of the graph at the point A.

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

(a) Find g(3).

..... [1]

(b) Find $f(x-2)$, giving your answer in its simplest form.

..... [2]

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

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

(d) $gf(x) - g(x)f(x) = 3x^3 + ax^2 + bx + c$

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

$a =$ .....

$b =$ .....

$c =$ ..... [5]

(e) Find $\mathrm{h}(x) - \mathrm{f}(x)$, giving your answer as a single fraction in its simplest form.

..... [3]

(f) $\mathrm{h}(x^n) = 3x^7$

Find the value of n.

$n =$ ..... [1]

43. Nov/2023/Paper_0580/43/No.6

$f(x) = 5x - 3$ $\quad$ $g(x) = 64^x$ $\quad$ $h(x) = \frac{2}{x+1}, \quad x \neq -1$

(a) Find the value of

(i) $f(2)$

..... [1]

(ii) $gf(0.5)$.

..... [2]

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

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

(c) Find x when $g(x) = \frac{1}{2^5}$.

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

(d) Write as a single fraction in its simplest form $\frac{1}{f(x)} - h(x)$.

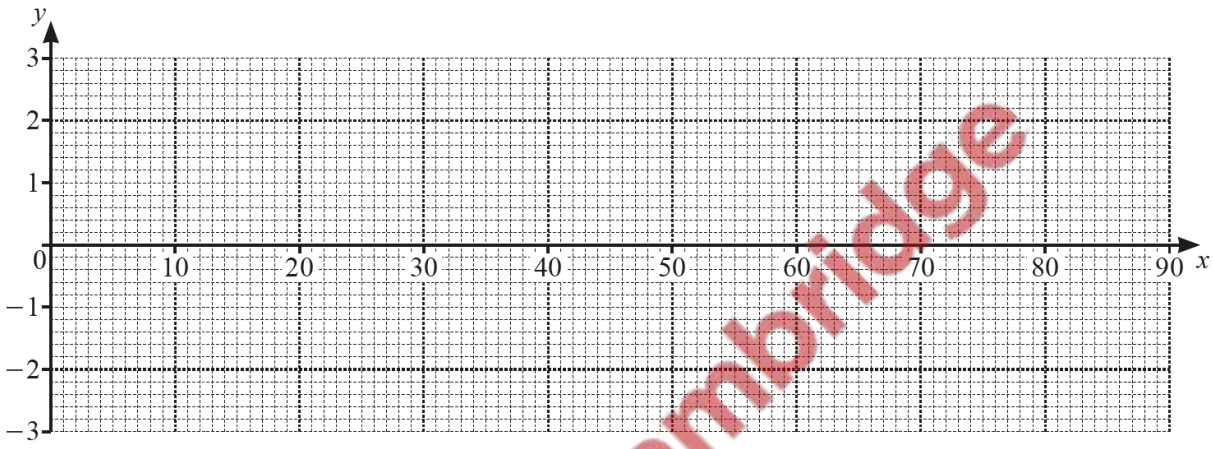
44. Nov/2023/Paper_0580/43/No.7

(a) Complete the table of values for $y = 3\cos 2x°$.
Values are given correct to 1 decimal place.

x	0	10	20	30	40	45	50	60	70	80	90
y	3.0	2.8	2.3	1.5	0.5		−0.5		−2.3		−3.0

[3]

(b) Draw the graph of $y = 3\cos 2x°$ for $0 \leqslant x \leqslant 90$.



[4]

(c) Use your graph to solve the equation $3\cos 2x° = -2$ for $0 \leqslant x \leqslant 90$.

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

(d) By drawing a suitable straight line, solve the equation $120\cos 2x° = 80 - x$ for $0 \leqslant x \leqslant 90$.

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

45. Nov/2023/Paper_0580/43/No.10

(a) Expand and simplify.

$$4(2x-1)-6(3-x)$$

..... [2]

(b) Factorise completely.

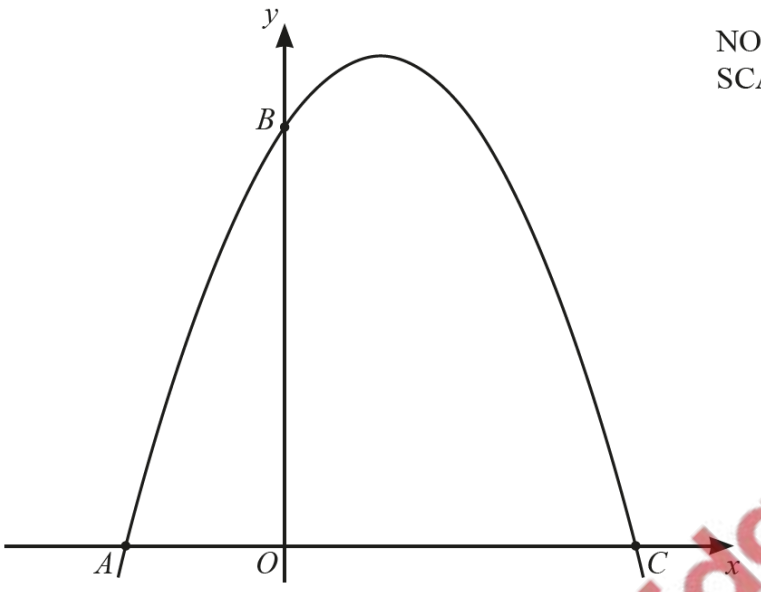
(i) $6x^2y+9xy$

..... [2]

(ii) $4x^2-y^2+8x+4y$

..... [3]

46. Nov/2023/Paper_0580/43/No.11



NOT TO SCALE

The diagram shows a sketch of $y = 18 + 5x - 2x^2$.

(a) Find the coordinates of the points A, B and C.

A (..... , ...)

B (..... , ...)

C (..... , ...) [4]

(b) Differentiate $18 + 5x - 2x^2$.

..... [2]

(c) Find the coordinates of the point on $y = 18 + 5x - 2x^2$ where the gradient is 17.