

1. Nov/2020/Paper_13/No.18

Expand and simplify.

$$4(2m+3) - 5(m-2)$$

$$8m + 12 - 5m + 10$$

$$8m - 5m + 12 + 10$$

$$3m + 22$$

$$3m + 22$$

[2]

2. Nov/2020/Paper_13/No.23

Solve the system of linear equations.

You must show all your working.

$$3x - 8y = 22$$

$$x + 4y = 4$$

$$\begin{array}{r} 3x - 8y = 22 \\ x + 4y = 4 \end{array} \times 2$$

$$\begin{array}{r} 3x - 8y = 22 \\ + 2x + 8y = 8 \\ \hline 5x = 30 \end{array}$$

$$x = 6$$

$$6 + 4y = 4, \quad 4y = 4 - 6$$

$$4y = -2$$

$$y = -\frac{2}{4}$$

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

$$x = \frac{6}{\dots\dots\dots}$$

$$y = -\frac{1}{2} \dots\dots\dots [3]$$

3. Nov/2020/Paper_23/No.4

Simplify.

$$\begin{aligned} a^2 \div a^6 \\ a^2 \div a^6 \\ a^{2-6} \\ = a^{-4} \\ = \frac{1}{a^4} \end{aligned}$$

$$\frac{1}{a^4} \quad [1]$$

4. Nov/2020/Paper_23/No.9

Work out $1\frac{1}{7} \times 2\frac{1}{10}$.

Give your answer as a mixed number in its simplest form.

$$\begin{aligned} 1\frac{1}{7} \times 2\frac{1}{10} \\ \frac{8}{7} \times \frac{21}{10} \\ = \frac{12}{5} \\ = 2\frac{2}{5} \end{aligned}$$

$$2\frac{2}{5} \quad [3]$$

5. Nov/2020/Paper_23/No.10

Solve the system of linear equations.
You must show all your working.

$$\begin{aligned} 3x - 8y &= 22 \\ x + 4y &= 4 \end{aligned}$$

$$\begin{aligned} 3x - 8y &= 22 \quad \times 1 \\ x + 4y &= 4 \quad \times 2 \\ \hline 3x - 8y &= 22 \\ + 2x + 8y &= 8 \\ \hline 5x &= 30 \\ \frac{5x}{5} &= \frac{30}{5} \\ x &= 6 \end{aligned}$$

$$\begin{aligned} x + 4y &= 4 \\ 6 + 4y &= 4 \\ 4y &= 4 - 6 \\ 4y &= -2 \\ \frac{4y}{4} &= \frac{-2}{4} \\ y &= -\frac{1}{2} \text{ or } -0.5 \end{aligned}$$

$$\begin{aligned} x &= 6 \\ y &= -0.5 \end{aligned} \quad [3]$$

6. Nov/2020/Paper_23/No.15

$$m = 2p + \sqrt{\frac{x}{y}}$$

Solve for x.

$$\begin{aligned} m &= 2p + \sqrt{\frac{x}{y}} \\ (m - 2p) &= \sqrt{\frac{x}{y}} \\ (m - 2p)^2 &= \frac{x}{y} \\ y(m - 2p)^2 &= x \end{aligned}$$

$$x = y(m - 2p)^2 \quad [3]$$

7. Nov/2020/Paper_23/No.18

(a) Simplify.

$$(4xy^2)^3$$

$$(4xy^2)^3$$

$$4^3 x^3 y^{2 \times 3}$$

$$= \underline{\underline{64x^3y^6}}$$

$$64x^3y^6 \dots \dots \dots [2]$$

(b) $25 = 125^k$

Find the value of k .

$$5^2 = 5^{3(k)}$$

$$\frac{2}{3} = \frac{3k}{3} \quad k = \underline{\underline{\frac{2}{3}}}$$

$$k = \frac{2}{3} \dots \dots \dots [1]$$

8. Nov/2020/Paper_23/No.19

Robert makes model cars.

The cost, $C(n)$, in dollars, of making n cars is given by the function $C(n) = 20 + 15n$.

(a) In one week, he makes at least 1 car and at most 5 cars.

Write down the domain and range of $C(n)$.

$$\text{Domain} = 1, 2, 3, 4, 5 \dots \dots \dots$$

$$\text{Range} = 35, 50, 65, 80, 95 \dots \dots \dots [2]$$

(b) By selling n cars, Robert receives $\$22n$.

Find the smallest number of cars he must sell to make a profit.

$$22n = 20 + 15n$$

$$22n - 15n = 20$$

$$7n = 20$$

$$\frac{7n}{7} = \frac{20}{7}$$

$$n = 2.85$$

$$\approx \underline{\underline{3}}$$

$$\dots \dots \dots 3 \dots \dots \dots [3]$$

9. Nov/2020/Paper_23/No.20

Factor.

$$3x + 8y - 6ax - 16ay$$

$$3x + 8y - 6ax - 16ay$$

$$3x - 6ax + 8y - 16ay$$

$$\frac{3x(1-2a) + 8y(1-2a)}{(3x+8y)(1-2a)}$$

$$\frac{(3x+8y)(1-2a)}{\dots\dots\dots} [2]$$

10. Nov/2020/Paper_23/No.24

Simplify.

$$\frac{x^2 - 25}{x^2 - 17x + 60}$$

$$x^2 - 25 = (x+5)(x-5)$$

$$x^2 - 17x + 60$$

$$P = 60 \quad (-12, -5)$$

$$S = -17$$

$$x^2 - 12x - 5x + 60$$

$$x(x-12) - 5(x-12)$$

$$= \underline{(x-5)(x-12)}$$

12

$$a^2 - b^2 = (a+b)(a-b)$$

$$\frac{(x-5)(x+5)}{(x-5)(x-12)}$$

$$= \frac{x+5}{x-12}$$

$$\frac{x+5}{x-12}$$

[4]

(a) Complete the table of values for $y = 1 + 5x - x^2$.

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

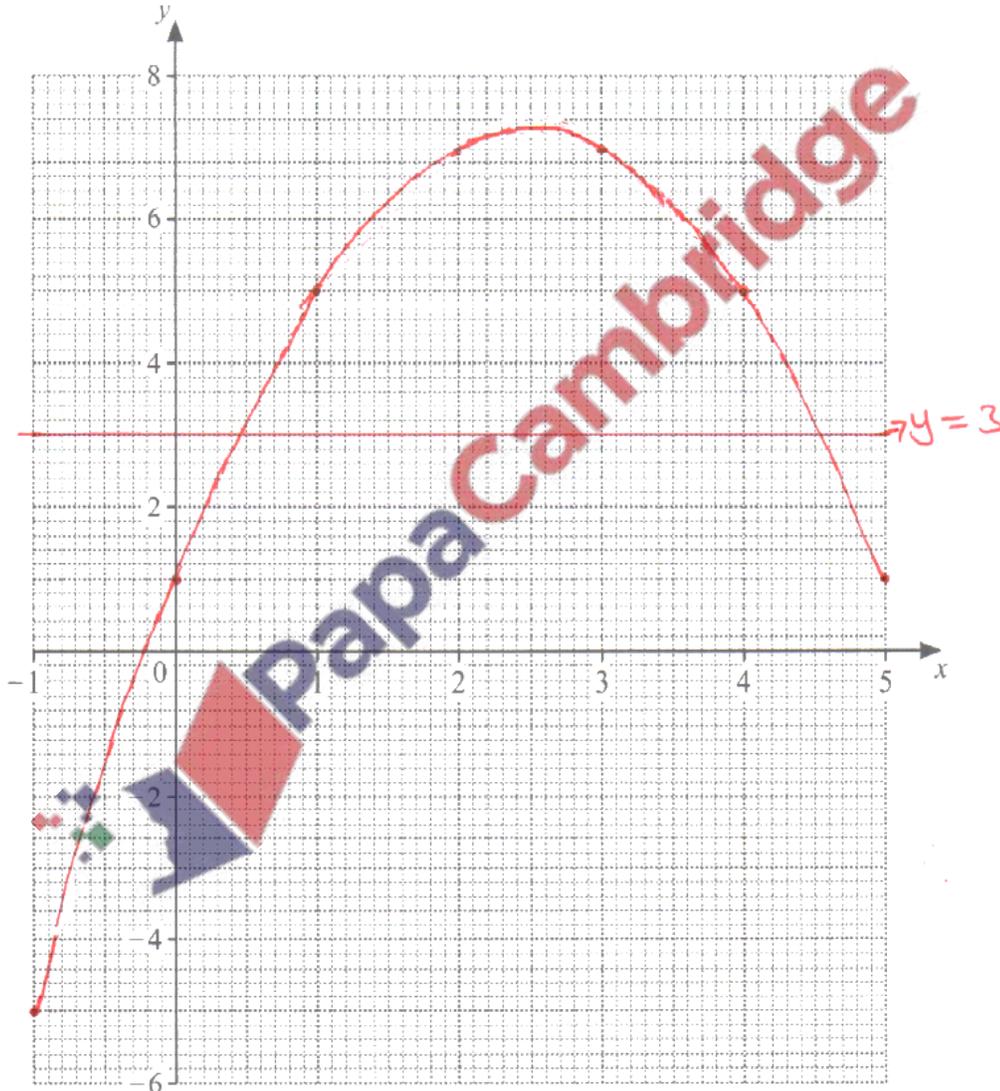
$$y = 1 + 5(-1) - (-1)^2 \quad \left| \quad y = 1 + 5(2) - (2)^2 \quad \left| \quad y = 1 + 5(4) - (4)^2 \right.$$

$$y = 1 - 5 - 1 \quad \left| \quad y = 1 + 10 - 4 \quad \left| \quad y = 1 + 20 - 16 \right.$$

$$y = -5 \quad \left| \quad y = 7 \quad \left| \quad y = 21 - 16 \right.$$

$$y = 5 \quad \left[2 \right]$$

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



[4]

(c) (i) On the grid, draw the line $y = 3$.

[1]

(ii) Use your line to solve the equation $1 + 5x - x^2 = 3$.

$x = 0.45$ or $x = 4.5$ [2]

12. Nov/2020/Paper_33/No.7

(a) $W = 3a + 5c$

Find the value of W when $a = 6$ and $c = 2$.

$$\begin{aligned} W &= 3(6) + 5(2) \\ &= 18 + 10 \\ &= 28 \end{aligned}$$

$W = \dots\dots\dots 28 \dots\dots\dots [2]$

(b) Factor completely.

$12b + 8b^2$

$$4b(3 + 2b)$$

$\dots\dots\dots 4b(3 + 2b) \dots\dots\dots [2]$

(c) Solve for m .

$y = 4m - p$

$$y + p = 4m$$

$$m = \frac{y + p}{4}$$

$m = \dots\dots\dots \frac{y + p}{4} \dots\dots\dots [2]$

(d) Find the value of x when $5^x \times 5^3 = 5^{12}$.

$$5^{x+3} = 5^{12}$$

$$x + 3 = 12$$

$$x = 12 - 3$$

$$x = 9$$

$x = \dots\dots\dots 9 \dots\dots\dots [1]$

(e) Find the value of

(i) 3^0 ,

any number to power zero = 1

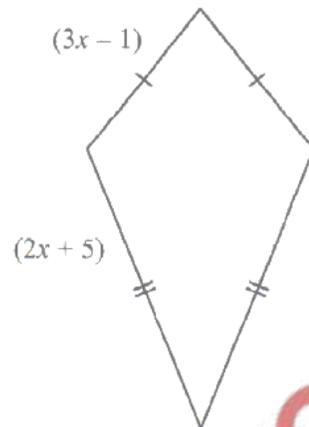
..... 1 [1]

(ii) 5^{-2} .

$$5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

..... 0.04 [1]

(f) In this part, all measurements are in centimeters.



NOT TO SCALE

The diagram shows a kite with sides $(2x+5)$ and $(3x-1)$.
The perimeter of the kite is 33 cm.

Work out the length of a shorter side.

$$2(3x - 1 + 2x + 5) = 33$$

$$2(5x + 4) = 33$$

$$10x + 8 = 33$$

$$10x = 33 - 8$$

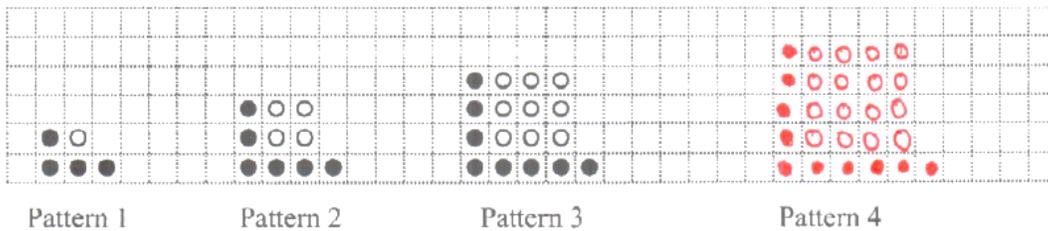
$$10x = 25$$

$$x = 2.5$$

$$\begin{aligned} &3(2.5) - 1 \\ &7.5 - 1 \\ &= \underline{\underline{6.5}} \end{aligned}$$

..... 6.5 cm [5]

A sequence of patterns is made using black counters and white counters.



- (a) Draw Pattern 4. [1]
 (b) Complete the table.

Pattern	1	2	3	4	5
Number of black counters	4	6	8	10	12
Number of white counters	1	4	9	16	25

- (c) Write an expression, in terms of n , for

- (i) the number of black counters in Pattern n ,

4, 6, 8, ...
 $a + d(n-1)$
 $4 + 2(n-1)$

$4 + 2n - 2$
 $2n + 2$

$2n + 2$

- (ii) the number of white counters in Pattern n .

n^2

n^2

- (d) Elena has 30 black counters and 140 white counters.

Can she make Pattern 12 using her counters?
 Explain your answer.

NO because Pattern 12 needs 144 white counters
 since $(12^2) = 144$.

(a) Find the integer values that satisfy the inequality $2 < 2x \leq 10$.

$$\frac{2}{2} < \frac{2x}{2} \leq \frac{10}{2}$$

$$1 < x \leq 5$$

$$2, 3, 4, 5$$

2, 3, 4, 5
..... [2]

(b) Factor.

(i) $6y^2 - 15xy$

$$6y^2 - 15xy$$

$$\underline{\underline{3y(3y - 5x)}}$$

3y(3y - 5x)
..... [2]

(ii) $y^2 - 9x^2$

$$y^2 - 9x^2$$

$$(y - 3x)(y + 3x)$$

(y - 3x)(y + 3x)
..... [2]

(c) Simplify.

$$\frac{3}{x-1} - \frac{2}{2x+1}$$

$$\frac{3}{x-1} - \frac{2}{2x+1}$$

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

$$\frac{6x+3 - 2x+2}{(x-1)(2x+1)}$$

$$\frac{4x+5}{(x-1)(2x+1)}$$

$\frac{4x+5}{(x-1)(2x+1)}$
..... [3]

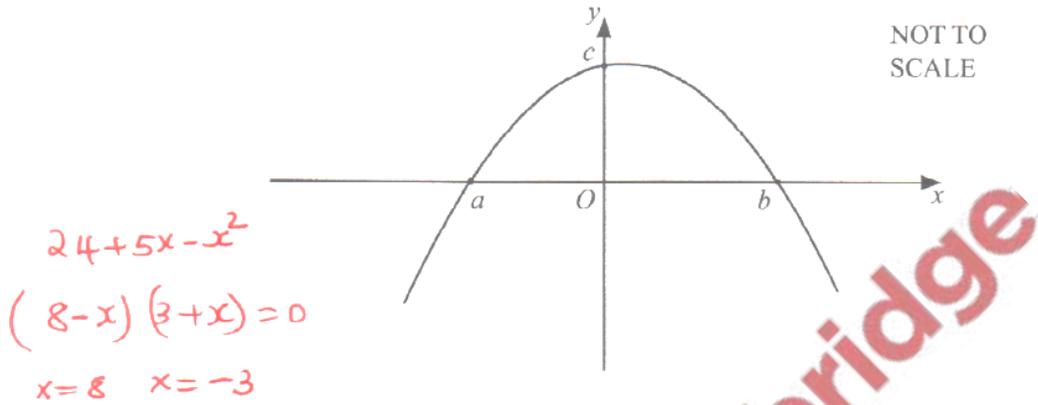
(a) (i) Factor $24+5x-x^2$.

$$\begin{aligned}
 P &= -24 \quad (8, 3) \\
 c &= 5 \\
 24 + 8x - 3x - x^2 \\
 8(3+x) - x(3+x)
 \end{aligned}$$

$$\underline{\underline{(8-x)(3+x)}}$$

$$\underline{\underline{(8-x)(3+x)}} \dots [2]$$

(ii) The diagram shows a sketch of $y = 24+5x-x^2$.



Work out the values of a , b , and c .

$$\begin{aligned}
 8(3+x) - x(3+x) \\
 (8-x)(3+x) \quad a = -3 \\
 x-8 = 0 \quad x+3 = 0 \quad b = 8 \\
 x = \underline{\underline{8}} \quad x = \underline{\underline{-3}} \quad c = \underline{\underline{24}}
 \end{aligned}$$

$$\begin{aligned}
 a &= \underline{\underline{-3}} \\
 b &= \underline{\underline{8}} \\
 c &= \underline{\underline{24}} \dots [3]
 \end{aligned}$$

(iii) The line $y = 18$ intersects the graph of $y = 24+5x-x^2$ at P and Q .

Find the length of PQ .

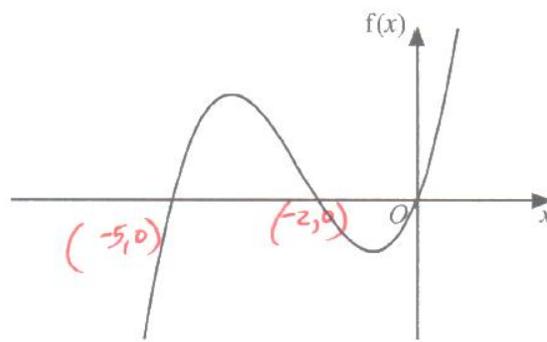
$$\begin{aligned}
 18 &= 24+5x-x^2 \\
 18-24 &= 5x-x^2 \\
 -6 &= 5x-x^2 \\
 6+5x-x^2 &= 0 \\
 P &= -6 \quad (6, 1) \\
 c &= 5 \\
 (x-6)(x+1) \\
 x = \underline{\underline{6}} \quad x = \underline{\underline{-1}} \\
 P &= (6, 18) \quad Q = (-1, 18)
 \end{aligned}$$

$$PQ = \left(\begin{matrix} -1 \\ 18 \end{matrix} \right) - \left(\begin{matrix} 6 \\ 18 \end{matrix} \right) = \left(\begin{matrix} -7 \\ 0 \end{matrix} \right)$$

$$\begin{aligned}
 PQ &= \left(\begin{matrix} -7 \\ 0 \end{matrix} \right) \\
 PQ &= \sqrt{(-7)^2 + (0)^2} \\
 &= \sqrt{49} \\
 &= \underline{\underline{7 \text{ units}}}
 \end{aligned}$$

$$PQ = \underline{\underline{7 \text{ units}}} \dots [4]$$

(b)



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The diagram shows a sketch of the graph of a cubic function $f(x)$.
The graph passes through the points $(-5, 0)$, $(-2, 0)$, $(0, 0)$, and $(1, 36)$.

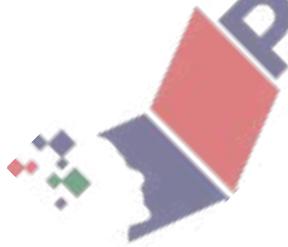
Find $f(x)$ in the form $ax^3 + bx^2 + cx$.

$$\begin{aligned}x &= -5, \quad x = -2 \\(x+5)(x+2) \\x(x+2) + 5(x+2) \\x^2 + 2x + 5x + 10 \\x^2 + 7x + 10 \\2x(x^2 + 7x + 10) \\2x^3 + 14x^2 + 20x\end{aligned}$$

The Curve also passes
through $x = 0$
 $x(x^2 + 7x + 10)$
 $= x^3 + 7x^2 + 10x$
 $f(x) = 2[x^3 + 7x^2 + 10x]$
 $= 2x^3 + 14x^2 + 20x$

$$2x^3 + 14x^2 + 20x$$

..... [6]



The table shows the first four terms in sequences A , B , C and D .

Sequence	1st term	2nd term	3rd term	4th term	5th term	n th term
A	4	9	14	19	24	$5n-1$
B	3	10	29	66	127	n^3+2
C	1	4	16	64	256	$4^{(n-1)}$
D	$\frac{3}{17}$	$\frac{4}{26}$	$\frac{5}{37}$	$\frac{6}{50}$	$\frac{7}{65}$	$\frac{n+2}{(n+3)^2+1}$

Complete the table.

$$a+(n-1)d$$

$$4+(n-1)5$$

$$4+5n-5$$

$$\underline{\underline{5n-1}}$$

$$\frac{n+2}{(n+3)^2+1}$$

Handwritten work for sequence D:

$\frac{3}{17}$ $\frac{4}{26}$ $\frac{5}{37}$ $\frac{6}{50}$ $\frac{7}{65}$
 9 11 13 15

$3 \sqrt{10} \sqrt{19} \sqrt{66}$
 $7 \sqrt{12} \sqrt{18} \sqrt{24}$
 6
 n^3+2

$4 \sqrt{16} \sqrt{64}$
 $3 \sqrt{12} \sqrt{48}$
 $4^0 \ 4^1 \ 4^2 \ 4^3 \ 4^4$
 $4^{(n-1)}$

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[12]

17. June/2020/Paper_11/No.14

(a) The n th term of a sequence is $60 - 8n$.

Find the largest number in this sequence.

$$60 - 8(1)$$
$$60 - 8 = 52$$

..... 52 [1]

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

12 19 26 33 40

Find an expression for the n th term of this sequence.

$$12 \quad 19 \quad 26$$
$$\quad \vee \quad \vee$$
$$\quad 7 \quad 7$$

$$a + d(n-1)$$
$$\rightarrow 12 + 7(n-1)$$
$$12 + 7n - 7$$
$$= 7n + 5$$

..... $7n + 5$ [2]

18. June/2020/Paper_11/No.15

Factor completely.

$$21a^2 + 28ab$$

$$7a(3a + 4b)$$

..... $7a(3a + 4b)$ [2]

19. June/2020/Paper_11/No.17

Simplify.

$$p^5q^3 \times p^2q^{-4}$$

$$p^{5+2} q^{3-4} = p^7 q^{-1} \\ = \text{or } \frac{p^7}{q}$$

$$\frac{p^7}{q} \dots\dots\dots [2]$$

20. June/2020/Paper_11/No.18

Solve for x.

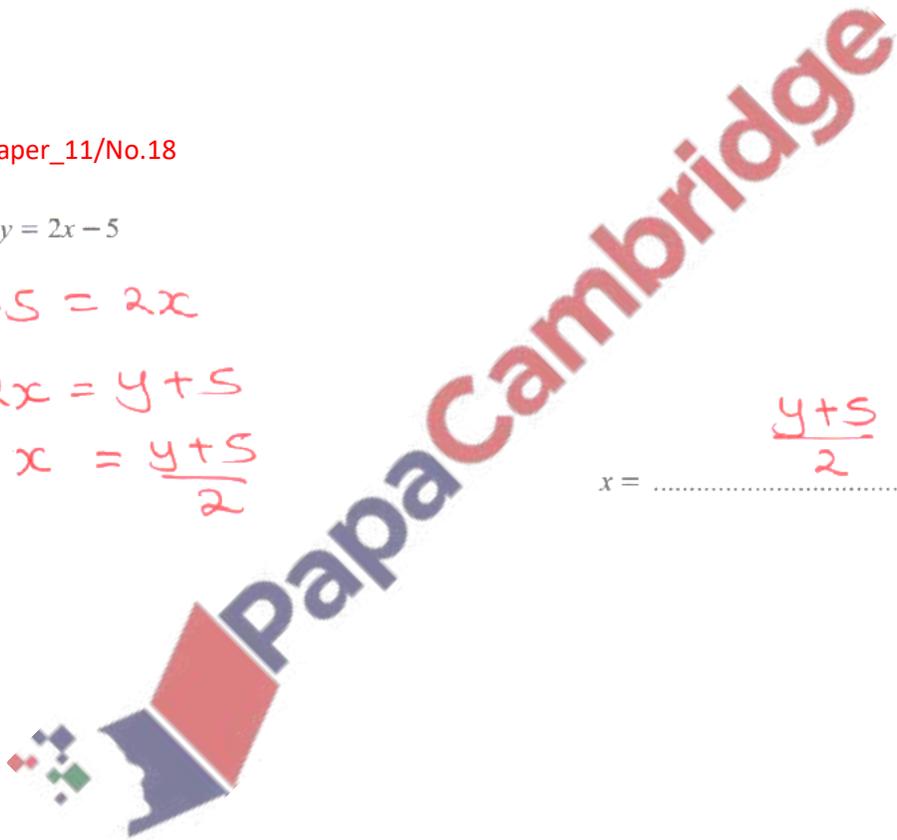
$$y = 2x - 5$$

$$y + 5 = 2x$$

$$2x = y + 5$$

$$x = \frac{y + 5}{2}$$

$$x = \frac{y + 5}{2} \dots\dots\dots [2]$$



21. June/2020/Paper_21/No.5

(a) The n th term of a sequence is $60 - 8n$.

Find the largest number in this sequence.

$$\begin{aligned}n=1 & 60 - 8n \\ & 60 - 8(1) \\ & = 60 - 8 \\ & = \underline{\underline{52}}\end{aligned}$$

..... 52 [1]

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

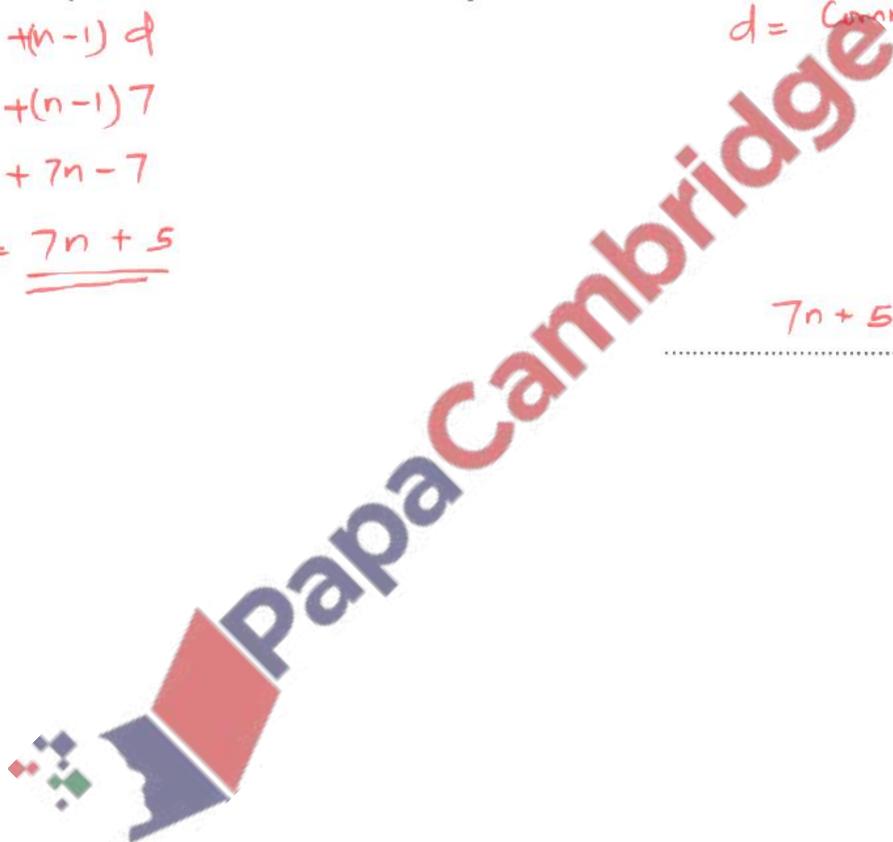
$$12 \quad \begin{array}{c} \vee \\ 7 \end{array} \quad 19 \quad \begin{array}{c} \vee \\ 7 \end{array} \quad 26 \quad \begin{array}{c} \vee \\ 7 \end{array} \quad 33 \quad \begin{array}{c} \vee \\ 7 \end{array} \quad 40$$

Find an expression for the n th term of this sequence.

$$\begin{aligned}& a + (n-1)d \\ & 12 + (n-1)7 \\ & 12 + 7n - 7 \\ & = \underline{\underline{7n + 5}}\end{aligned}$$

$a = 1st \text{ term}$
 $d = \text{Common difference}$

..... $7n + 5$ [2]



22. June/2020/Paper_21/No.9

Factor completely.

(a) $21a^2 + 28ab$

$$21a^2 + 28ab$$

$$7a(3a + 4b)$$

Consider Common factors: (7a)

$$7a(3a + 4b)$$

..... [2]

(b) $20x^2 - 45y^2$

$$20x^2 - 45y^2$$

$$5(4x^2 - 9y^2)$$

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

(Difference of two Squares)
 $4x^2 - 9y^2 = (2x+3y)(2x-3y)$

$$5[(2x+3y)(2x-3y)]$$

..... [3]

23. June/2020/Paper_21/No.20

Simplify.

$$\frac{x-8-ax+8a}{x^2-15x+56}$$

$$\frac{x-8-ax+8a}{x^2-15x+56}$$

$$= 1(x/8) - a(x/8)$$

$$= (1-a)(x-8)$$

$$x^2 - 15x + 56$$

P = 56 (-8, -7)
 S = -15

$$x^2 - 8x - 7x + 56$$

$$x(x/8) - 7(x/8)$$

$$(x-8)(x-7)$$

$$\frac{(1-a)(x/8)}{(x/8)(x-7)}$$

$$= \frac{(1-a)}{(x-7)}$$

$$\frac{1-a}{x-7}$$

..... [5]

24. June/2020/Paper_31/No.4

(a) Complete the table of values for $y = 7 + 2x - x^2$.

x	-2	-1	0	1	2	3	4
y	-1	4	7	8	7	4	-1

[2]

(b) On the grid, draw the graph of $y = 7 + 2x - x^2$ for $-2 \leq x \leq 4$.

$$y = 7 + 2(-1) - (-1)^2$$

$$y = 7 - 2 - 1$$

$$y = 7 - 3$$

$$y = 4$$

$$y = 7 + 2(0) - (0)^2$$

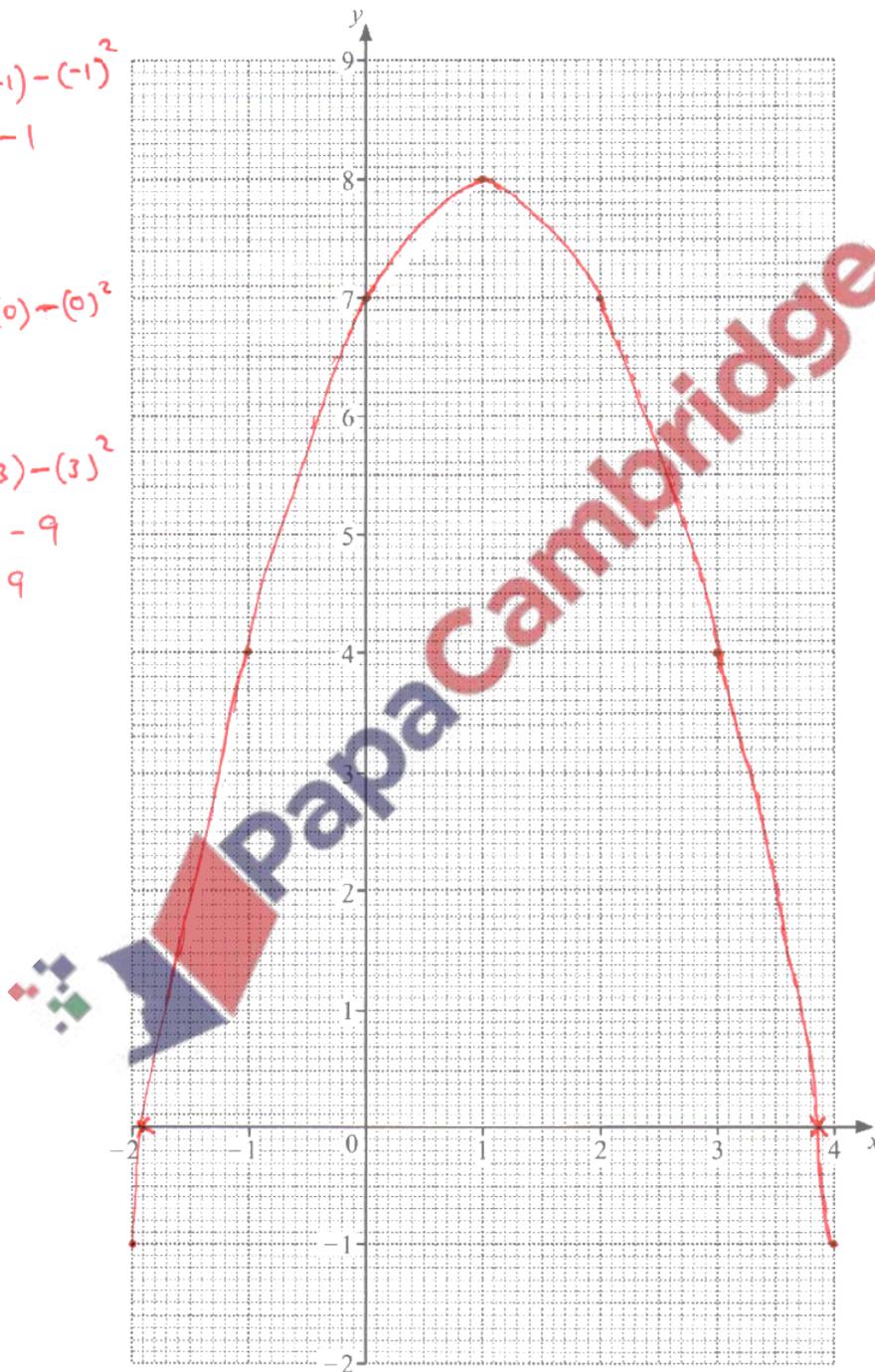
$$y = 7$$

$$y = 7 + 2(3) - (3)^2$$

$$y = 7 + 6 - 9$$

$$y = 13 - 9$$

$$y = \underline{4}$$



[4]

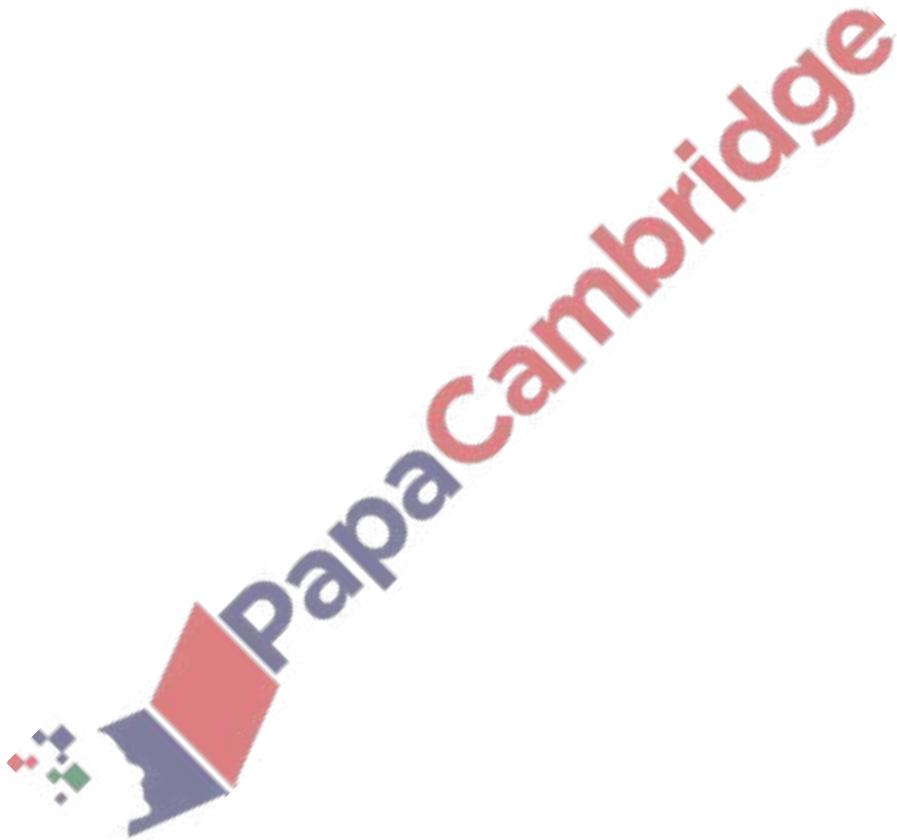
(c) Write down the equation of the line of symmetry of the graph.

$x = 1$ [1]

(d) Use your graph to solve the equation $7 + 2x - x^2 = 0$.

Values of x where the
Curve crosses the x -axis

$x = -1.9$ or $x = 3.8$ [2]



(a) Simplify $3c - 5d - c + 2d$.

$$\begin{aligned} 3c - c - 5d + 2d \\ 2c - 3d \end{aligned}$$

$$\dots\dots\dots 2c - 3d \quad [2]$$

(b) Solve the equation $12x - 7 = 23$.

$$\begin{aligned} 12x &= 23 + 7 \\ 12x &= 30 \\ x &= \frac{30}{12} = \frac{5}{2} \end{aligned}$$

$$x = 2.5$$

$$x = \dots\dots\dots 2.5 \quad [2]$$

(c) Expand.

$$9(3 - x)$$

$$27 - 9x$$

$$\dots\dots\dots 27 - 9x \quad [1]$$

$$(d) \quad A = \frac{(a+b)h}{2}$$

Work out the value of h when $A = 38.64$, $a = 5.5$, and $b = 3.7$.

$$2 \times 38.64 = \frac{(5.5 + 3.7)h}{2} \quad \times 2$$

$$2(38.64) = 9.2h$$

$$h = \frac{2(38.64)}{9.2}$$

$$h = \underline{\underline{8.4}}$$

$$h = \dots\dots\dots 8.4 \quad [3]$$

- (e) Alphonse is x years old and Beatrice is y years old.
 Three times Alphonse's age is equal to 5 times Beatrice's age.
 Twice Beatrice's age is 4 years more than Alphonse's age.

(i) Use this information to write down two equations in x and y .

$$A = x$$

$$B = y$$

$$3x = 5y,$$

$$2y = x + 4$$

$$x = 2y - 4$$

$$3x = 5y$$

$$2y = x + 4$$

[2]

(ii) Find the age of Alphonse and the age of Beatrice.

$$x = 2y - 4$$

$$3(2y - 4) = 5y$$

$$6y - 12 = 5y$$

$$6y - 5y = 12$$

$$y = 12$$

$$3x = 5 \times 12$$

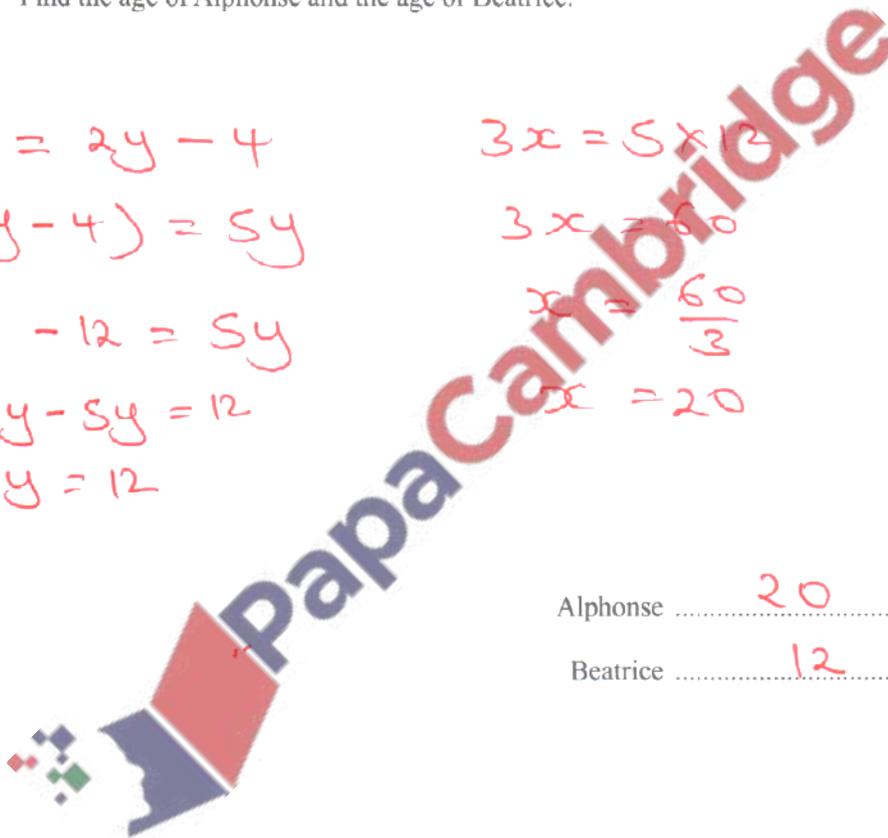
$$3x = 60$$

$$x = \frac{60}{3}$$

$$x = 20$$

Alphonse 20 years old

Beatrice 12 years old [3]



26. June/2020/Paper_41/No.4

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

Find the value of s when $u = 5.2$, $t = 7$ and $a = 1.6$.

$$s = ut + \frac{1}{2}at^2$$

$$s = 5.2(7) + \frac{1}{2}(1.6) \times 49$$

$$s = 36.4 + 39.2$$

$$= \underline{\underline{75.6}}$$

$s = \underline{\underline{75.6}}$ [2]

(b) Simplify.

(i) $3a - 5b - a + 2b$

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

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

$$\underline{\underline{2a - 3b}}$$

$\underline{\underline{2a - 3b}}$ [2]

(ii) $\frac{5}{3x} \times \frac{9x}{20}$

$$\frac{5^1 \times 9^3 x}{3x \times 20 \times 4} = \frac{3}{4}$$

$\underline{\underline{3/4}}$ [2]

(c) Solve.

(i) $\frac{15}{x} = -3$

$$\frac{15}{x} = -3 \times x$$

$$15 = \frac{-3x}{-3} \quad x = \underline{\underline{-5}}$$

$x = \underline{\underline{-5}}$ [1]

(ii) $4(5 - 3x) = 23$

$$20 - 12x = 23$$

$$-12x = 23 - 20$$

$$\frac{-12x}{-12} = \frac{3}{-12}$$

$$x = \underline{\underline{-1/4}}$$

$x = \underline{\underline{-1/4}}$ [3]

(d) Simplify.

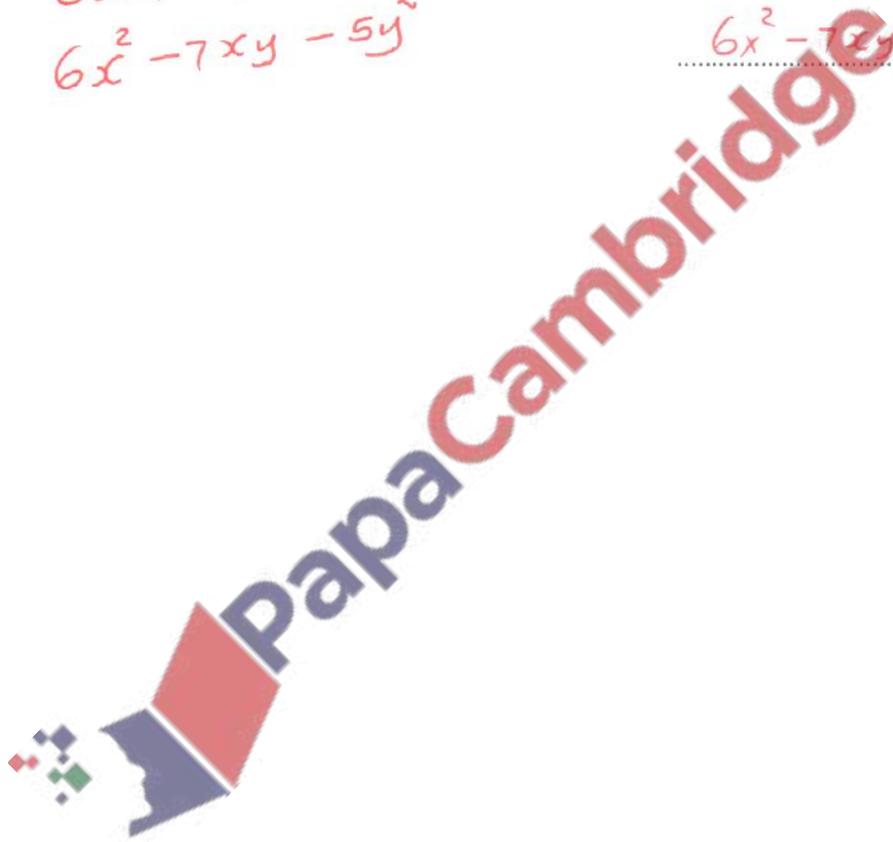
$$(27x^9)^{\frac{2}{3}}$$
$$= \left(\sqrt[3]{27}\right)^2 x^{9 \times \frac{2}{3}}$$
$$= 3^2 x^6 = \underline{\underline{9x^6}}$$

$$\dots\dots\dots 9x^6 \dots\dots\dots [2]$$

(e) Expand and simplify.

$$(3x - 5y)(2x + y)$$
$$3x(2x + y) - 5y(2x + y)$$
$$6x^2 + 3xy - 10xy - 5y^2$$
$$6x^2 - 7xy - 5y^2$$

$$\dots\dots\dots 6x^2 - 7xy - 5y^2 \dots\dots\dots [2]$$



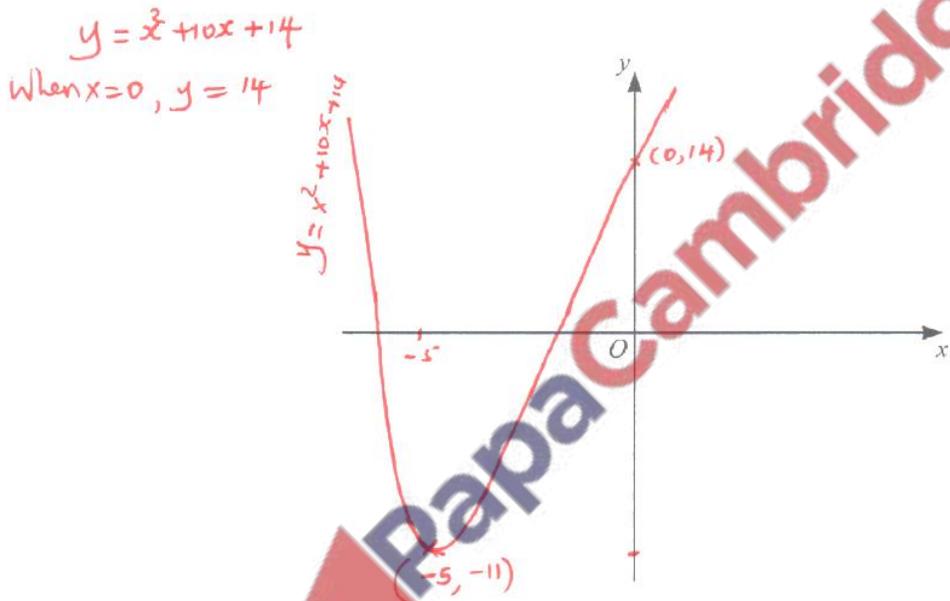
(b) (i) Write $x^2 + 10x + 14$ in the form $(x+a)^2 + b$.

$$\begin{array}{l}
 x^2 + 10x + 14 \\
 \left(x + \frac{10}{2}\right)^2 - \left(\frac{10}{2}\right)^2 + 14 \\
 (x+5)^2 - 25 + 14
 \end{array}
 \quad \left| \quad \begin{array}{l}
 \underline{\underline{(x+5)^2 - 11}} \\
 \\
 (x+5)^2 - 11
 \end{array}
 \right.
 \quad \dots\dots\dots [2]$$

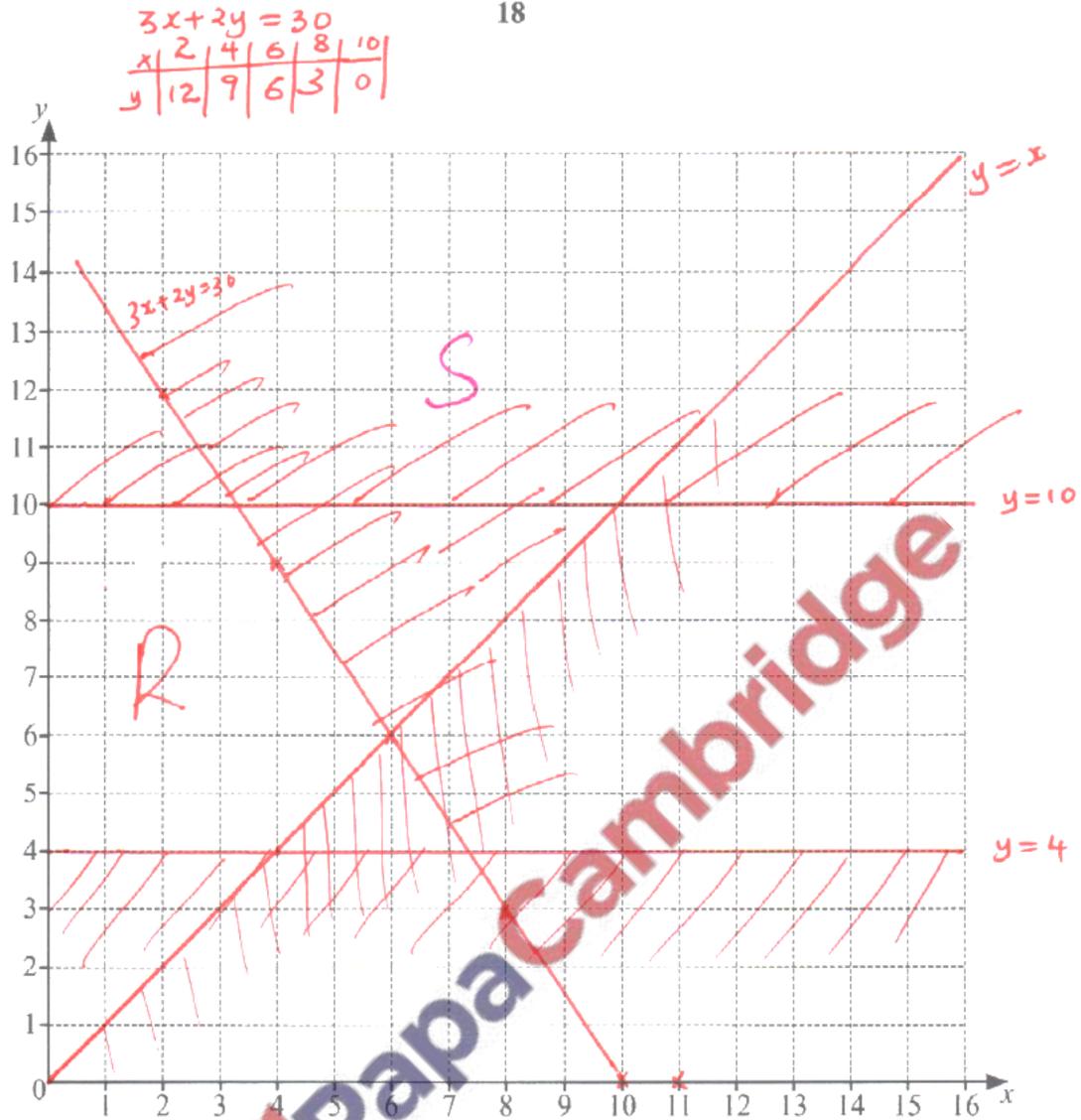
(ii) Write down the coordinates of the minimum point on the graph of $y = x^2 + 10x + 14$.

$$\begin{array}{l}
 y = x^2 + 10x + 14 \\
 (-a, b) \rightarrow \text{Minimum Point } (-5, -11) \\
 (x+5)^2 - 11 \\
 a = 5, b = -11
 \end{array}
 \quad \dots\dots\dots (-5, -11) \dots\dots\dots [2]$$

(iii) On the axes, sketch the graph of $y = x^2 + 10x + 14$.



[1]



(a) On the grid, draw the lines $y = 4$, $y = 10$, $y = x$ and $3x + 2y = 30$. [5]

(b) Label the region R where $x \geq 0$, $y \geq 4$, $y \leq 10$, $y \geq x$ and $3x + 2y \leq 30$. [1]

(c) For points in the region R , find

(i) the smallest value of $x + y$,

..... 4 [1]

(ii) the largest value of $x + y$ when x and y are integers.

..... 13 [1]

(d) Label the region S where $y \geq 10$, $y \geq x$ and $3x + 2y \geq 30$. [1]