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Topical Worksheets for Cambridge O LEVEL Mathematics D (4024)

Algebra and Graphs

1st edition, for examination until 2025

1 Here are the first five terms of a sequence.

12 19 26 33 40

Find an expression for the nth term of this sequence.

..... [2]

[Total: 2]

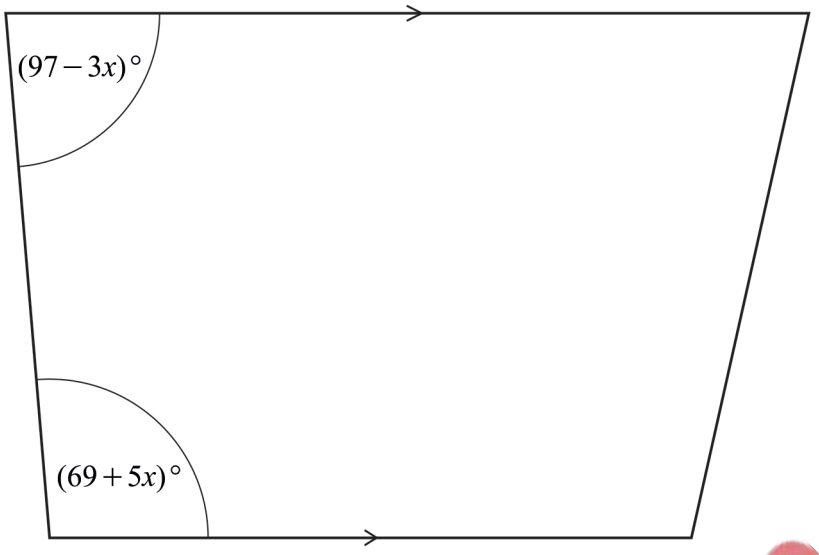
2 The nth term of a sequence is $60 - 8n$.

Find the largest number in this sequence.

..... [1]

[Total: 1]

3 The diagram shows a trapezium.



NOT TO SCALE

Work out the value of x.

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

[Total: 3]

4 Expand and simplify.

$(x - 5)(x - 7)$

..... [2]

[Total: 2]

5 Simplify.

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

..... [2]

[Total: 2]

6 Factorise completely.

$21a^2 + 28ab$

..... [2]

[Total: 2]

7 Rovers, United and City are football teams.

Rovers scored x goals.
United scored 8 goals more than Rovers.
City scored 3 goals less than twice the number of goals scored by Rovers.

The three teams scored a total of 117 goals.

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

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

[Total: 4]

8 Des thinks of two numbers.
The sum of his two numbers is −6.
The difference between his two numbers is 62.

Find the two numbers.

..... and ..... [4]

[Total: 4]

9 Simplify $8t^8 \div 4t^4$.

..... [2]

[Total: 2]

10 Simplify.

(a) $p^2 \times p^4$

..... [1]

(b) $m^{15} \div m^5$

..... [1]

(c) $\left(k^3\right)^5$

..... [1]

[Total: 3]

11 Simplify.
$5w + 3h - 7w + 8h$

..... [2]

[Total: 2]

12 The curve $y = x^2 - 2x + 1$ is drawn on a grid.

A line is drawn on the same grid.
The points of intersection of the line and the curve are used to solve the equation $x^2 - 7x + 5 = 0$.

Find the equation of the line in the form $y = mx + c$.

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

[Total: 1]

13 m is inversely proportional to the square of $(p - 1)$.
When $p = 4$, $m = 5$.

Find m when $p = 6$.

$m =$ ..... [3]

[Total: 3]

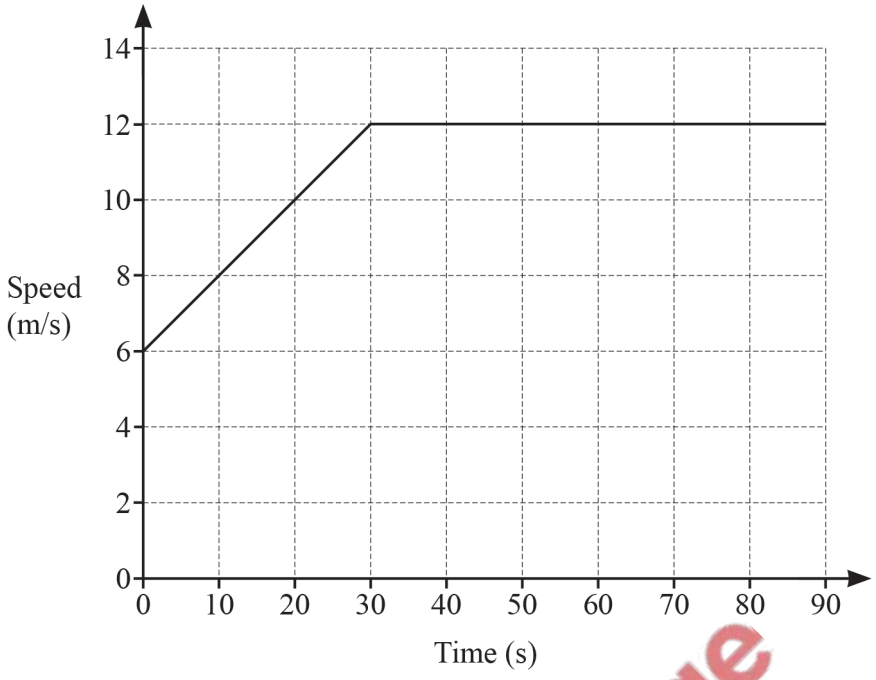
14 Factorise completely.

$20x^2 - 45y^2$

..... [3]

[Total: 3]

15



The diagram shows the speed–time graph for 90 seconds of a journey.

Calculate the total distance travelled during the 90 seconds.

..... m [3]

[Total: 3]

16 $\mathrm{h}(x) = \dfrac{5x - 1}{3}$

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

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

[Total: 3]

17 Expand and simplify $(x + 3)(x - 5)(3x - 1)$.

..... [3]

[Total: 3]

18 $\mathrm{f}(x) = 4x + 3$ $\mathrm{g}(x) = 5x - 4$

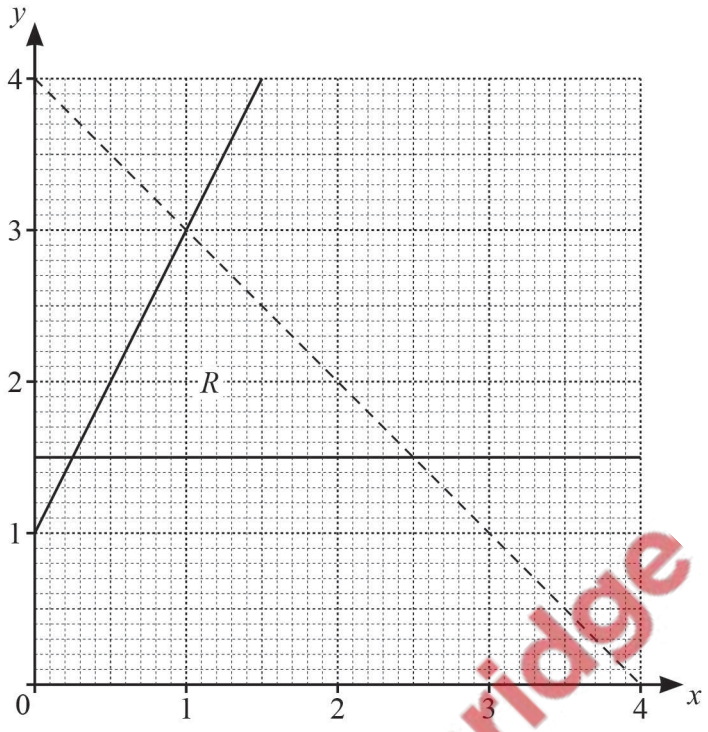
$\mathrm{fg}(x) = 20x + p$

Find the value of p.

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

[Total: 2]

19



Write down the three inequalities that define the region R.

.....

.....

..... [4]

[Total: 4]

20 $\sqrt[3]{y^2} = \sqrt[6]{x}$ and $y = \sqrt[n]{x}$.

Find the value of n.

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

[Total: 2]

21 $y = mx + c$

Find the value of y when $m = -3$, $x = -2$ and $c = -8$.

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

[Total: 2]

22 Simplify.

$$\frac{2x^2 + x - 15}{ax + 3a - 2bx - 6b}$$

..... [5]

[Total: 5]

23 Simplify.

(a) $(5x^4)^3$

..... [2]

(b) $\left(256x^{256}\right)^{\frac{3}{8}}$

..... [2]

[Total: 4]

24 Make y the subject of the formula.

$h^2 = x^2 + 2y^2$

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

[Total: 3]

25 Solve the equation.

$\frac{1-x}{3} = 5$

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

[Total: 2]

26 Simplify.

$\frac{p}{2q} \times \frac{4pq}{t}$

..... [2]

[Total: 2]

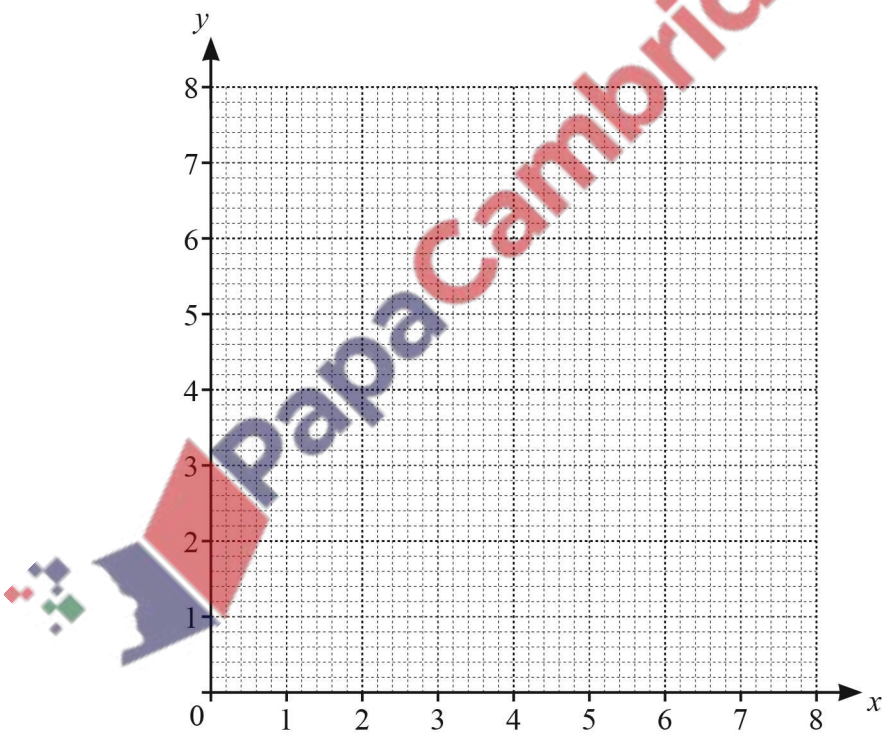
27 p is directly proportional to $(q + 2)^2$.
When $q = 1$, $p = 1$.

Find p when $q = 10$.

$p =$ ..... [3]

[Total: 3]

28



(a) By drawing suitable lines and shading unwanted regions, find the region, R, where

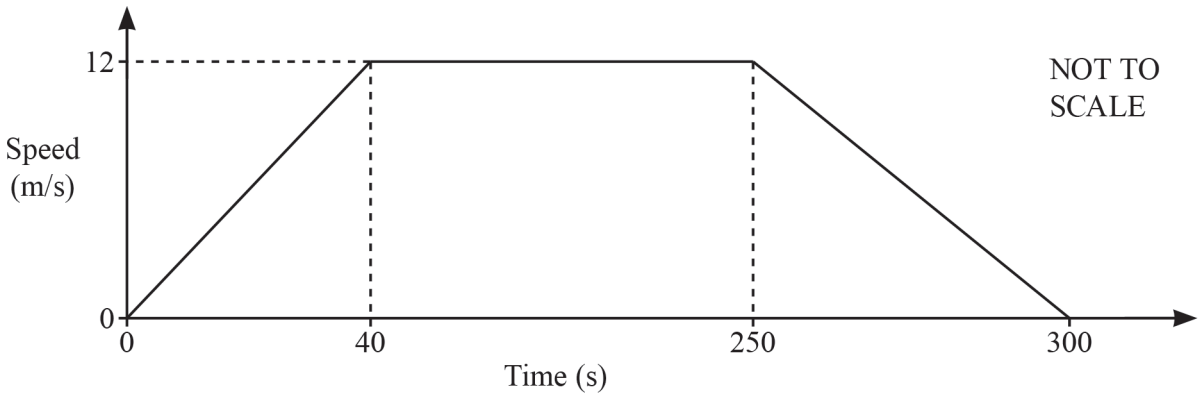
$x \geqslant 2$, $y \geqslant x$ and $2x + y \leqslant 8$. [5]

(b) Find the largest value of $x + y$ in the region R.

..... [1]

[Total: 6]

29 The diagram shows the speed–time graph of a train journey between two stations.



(a) Find the acceleration of the train during the first 40 seconds.

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

(b) Calculate the distance between the two stations.

..... m [3]

[Total: 4]

30 y is directly proportional to the cube root of $(x + 3)$.

When $x = 5$, $y = \frac{2}{3}$.

Find y when $x = 24$.

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

[Total: 3]

31 **(a)** Write $x^2 - 18x - 27$ in the form $(x + k)^2 + h$.

..... [2]

(b) Use your answer to **part (a)** to solve the equation $x^2 - 18x - 27 = 0$.

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

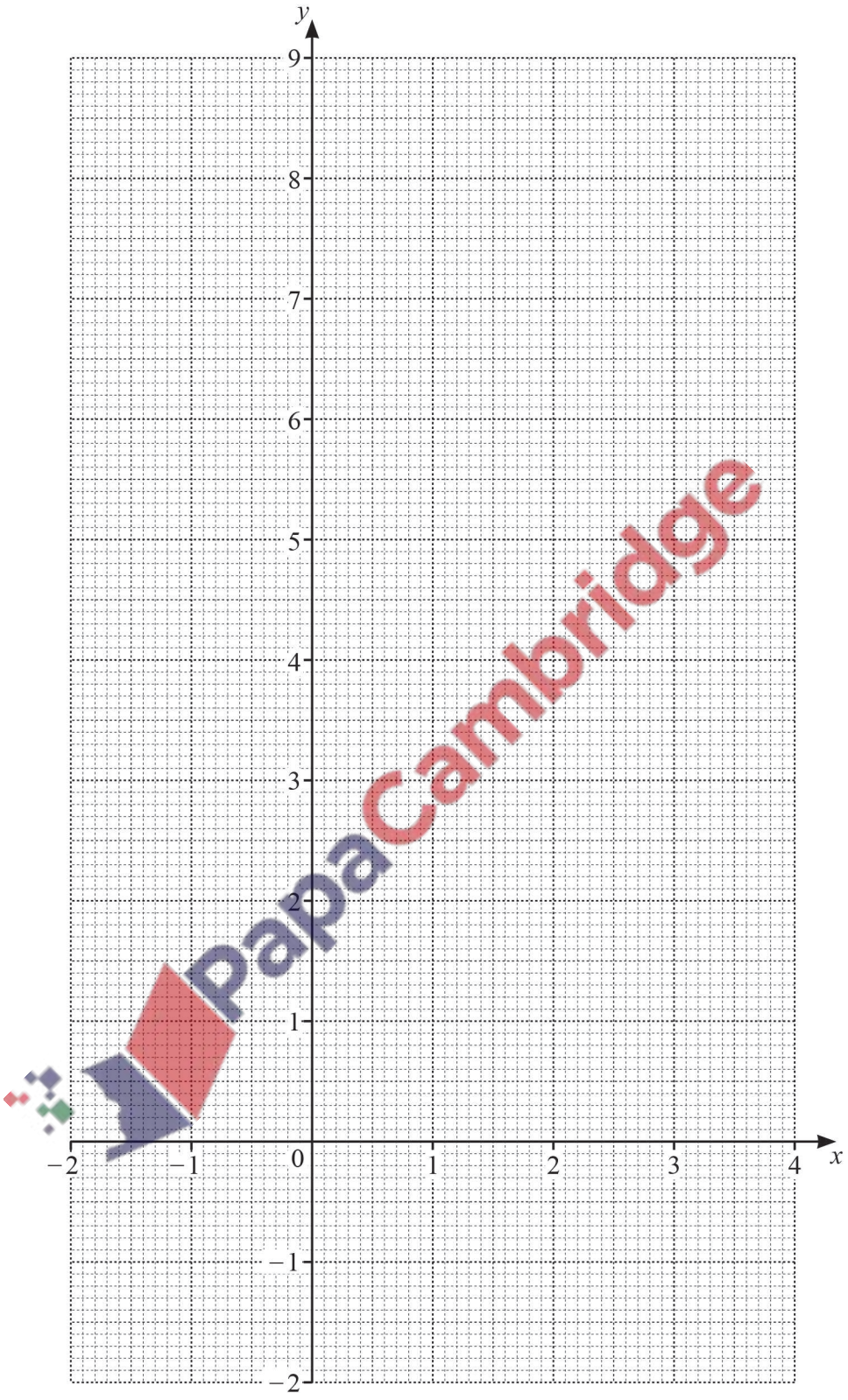
[Total: 4]

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

x	−2	−1	0	1	2	3	4
y	−1			8	7		−1

[2]

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



[4]

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

..... [1]

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

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

[Total: 9]

33 Solve the equation $12x - 7 = 23$.

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

[Total: 2]

34 There are 152 seats in a theatre.

- There are 12 seats in the front row.
- Each row has 2 more seats than the row in front of it.

Work out the number of rows for the 152 seats in the theatre.

..... rows [2]

[Total: 2]

35 $A = \dfrac{(a + b)h}{2}$

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

$h =$ ..... [3]

[Total: 3]

36 Multiply out.

$9\,(3 - x)$

..... [1]

[Total: 1]

37 Simplify $3c - 5d - c + 2d$.

..... [2]

[Total: 2]

38 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.

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

.....

..... [2]

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

Alphonse ..... years old

Beatrice ..... years old [3]

[Total: 5]

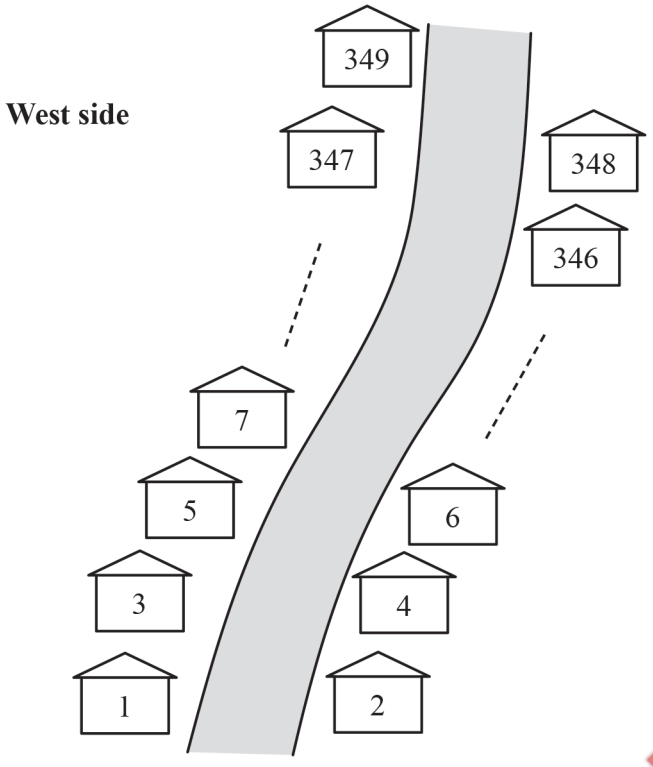
39 Factorise fully.

$5x - 20x^2$

..... [2]

[Total: 2]

40



NOT TO SCALE

A road has 349 houses on it numbered from 1 to 349.
The diagram shows some of these houses.
The houses on the West side of the road have odd numbers.
The houses on the East side have even numbers.

(a) Put a ring around the numbers in this list that are on the West side.

25 87 126 178 252 329

[1]

(b) On the East side, how many houses are there **between** the house numbered 168 and the house numbered 184?

..... [1]

(c) How many houses on the road have a house number that is a multiple of 39?

..... [2]

(d) Tomaz delivers a leaflet to every house on the West side of the road.
He starts at house number 1 and then delivers to each house in order.

(i) Find an expression, in terms of n, for the house number of the nth house he delivers to.

..... [2]

(ii) Work out the house number of the 40th house he delivers to.

..... [1]

(iii) Work out how many houses are on the West side of the road.

..... [2]

(e) Alicia delivers a leaflet to every house on the East side of the road.
She starts at house number 348 and then delivers to each house in order.

(i) Find an expression, in terms of n, for the house number of the nth house she delivers to.

..... [2]

(ii) What is the largest value of n that can be used in your expression?
Give a reason for your answer.

The largest value of n is ..... because .....

..... [2]

[Total: 13]