# GCSE
# MATHEMATICS (8300)
# HIGHER

Algebra

Total number of marks: 33 per optional item

**Q5**

Solve    $5(x + 3) < 60$

$5x + 15 < 60$
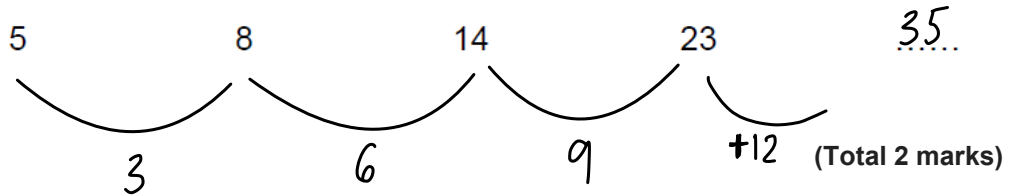
$5x < 45$

$x < 9$

(Total 2 marks)

**Q10**

Work out the next term of this quadratic sequence.

5    8    14    23    35

3    6    9    +12    (Total 2 marks)

→ goes up in 3s

**Q5**

Solve    $4(3x - 2) = 2x - 5$

$12x - 8 = 2x - 5$

$10x = 3$       $x = \underline{\quad 0.3 \quad}$
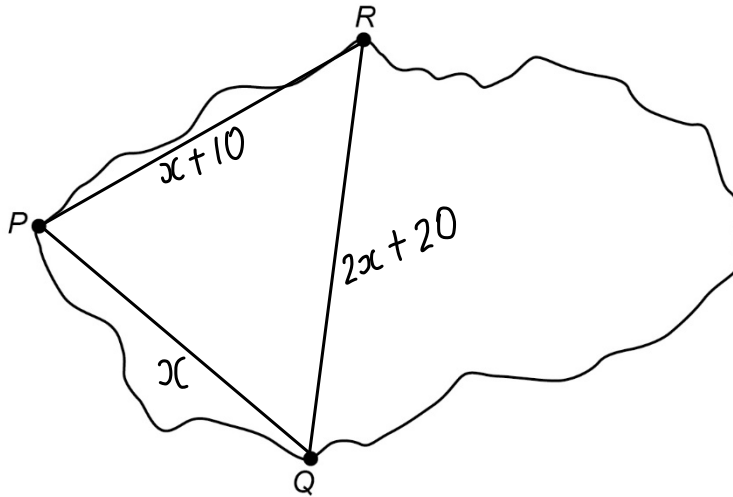
$x = \dfrac{3}{10} = 0.3$

(Total 3 marks)

**Q9**

Towns *P*, *Q* and *R* are connected by roads *PQ*, *PR* and *QR*.

PR is 10 km longer than *PQ*.

QR is twice as long as *PR*.

The total length of the three roads is 170 km

Not drawn accurately



Work out the length of *PQ*.

Answer _____ 35 _____ km

**(Total 4 marks)**

$$x + x + 10 + 2x + 20 = 170$$
$$4x + 30 = 170$$
$$4x = 140$$
$$x = 35$$

**Q26**

Expand and simplify $(x - 4)(2x + 3y)^2$

$$(x-4)\left(4x^2 + 6xy + 6xy + 9y^2\right)$$

$$(x-4)\left(4x^2 + 12xy + 9y^2\right)$$

$$4x^3 + 12x^2y + 9xy^2 - 16x^2 - 48xy - 36y^2$$

**Q2**

$P$ is (4, 9) and $Q$ is (−2, 1)

Circle the midpoint of $PQ$.

(1, 5)          (3, 4)          (3, 5)          (6, 8)

**(Total 1 mark)**

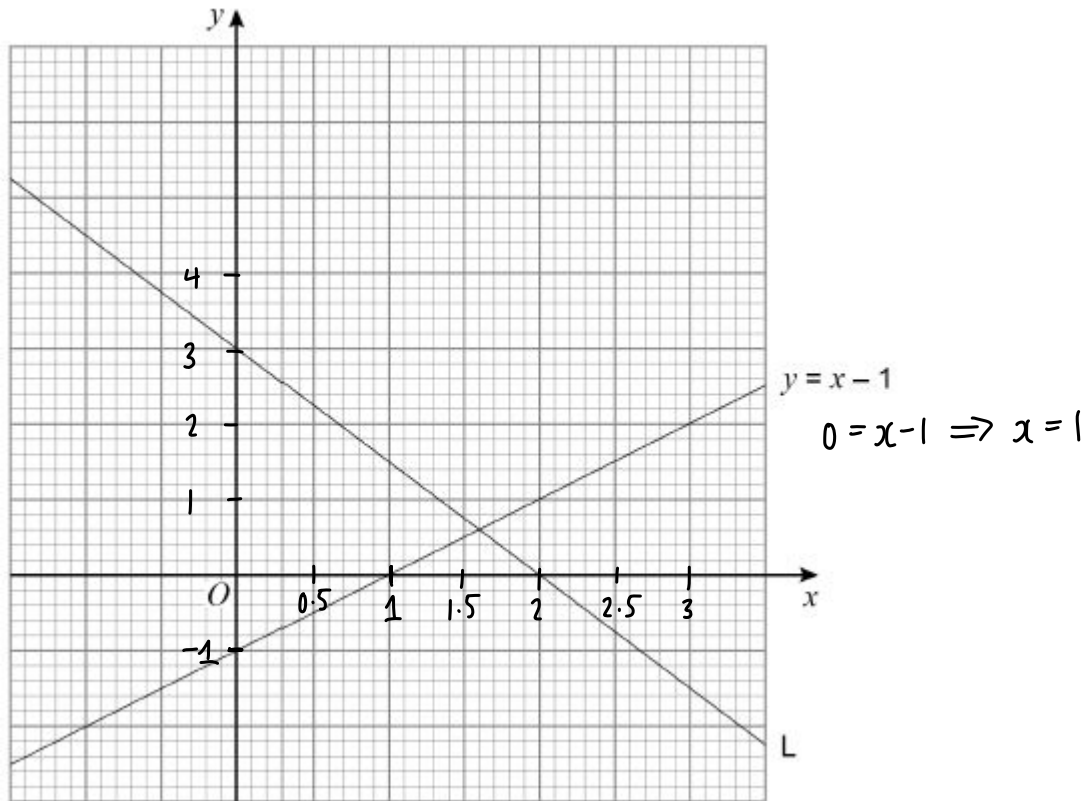$$\text{midpoint} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$= \left(\frac{4-2}{2}, \frac{9+1}{2}\right)$$

$$= (1, 5)$$

**Q15**

Here is line L and the graph of $y = x - 1$

The scales of the axes are not shown.



$y = x - 1$

$0 = x - 1 \Rightarrow x = 1$

Work out the equation of line L.

$y = mx + c$

$\Rightarrow 3 = 0 + c$

$\Rightarrow c = 3$

gradient $= \dfrac{-3}{2}$

$= -1.5$

**(Total 4 marks)**

equation of L = $\boxed{y = -1.5x + 3}$
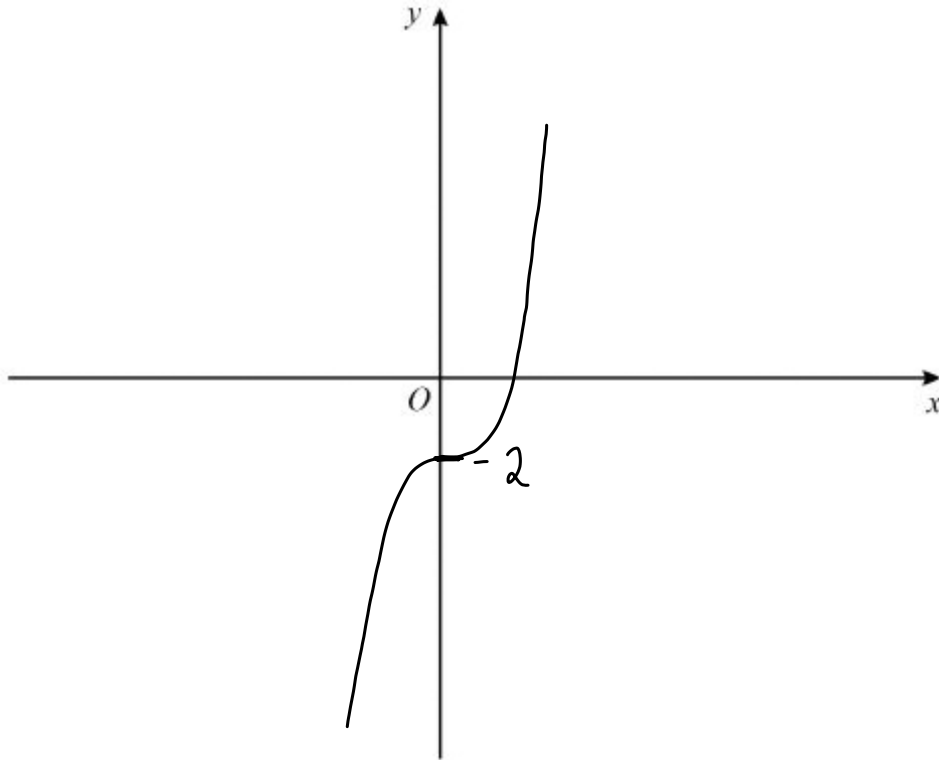
**Q8**

On the axes, sketch the curve $y = x^3 - 2$

You **must** show the coordinates of the $y$-intercept.



**(Total 2 marks)**

**Q21**

Here are the first four terms of a quadratic sequence.

11          26          45          68

15          19          23

4          4

Work out an expression for the $n$th term.

**(Total 3 marks)**

$4 \div 2 = 2n^2$

original $=$   11      26      45      68

$2n^2 = $   2      8      18      32

9      18      27      36

9      9      9   $\longrightarrow 9n$

$\therefore$ $n$th term $= 2n^2 + 9n$

**Q22**

The **only** solution to      $x^2 + bx + c = 0$      is      $x = 5$

Work out the values of $b$ and $c$.

$b = $ ___$-10$___          $c = $ ___$25$___

**(Total 2 marks)**

$(x-5)(x-5) = 0$

$x^2 - 10x + 25 = 0$

**Q26**

Here is an L-shape.

All dimensions are in centimetres.



Not drawn accurately

$9 - 3x - 1 = 8 - 3x$

$9$

$3x + 1$

$3x + 1$

$x$

$10 - x$

$10$
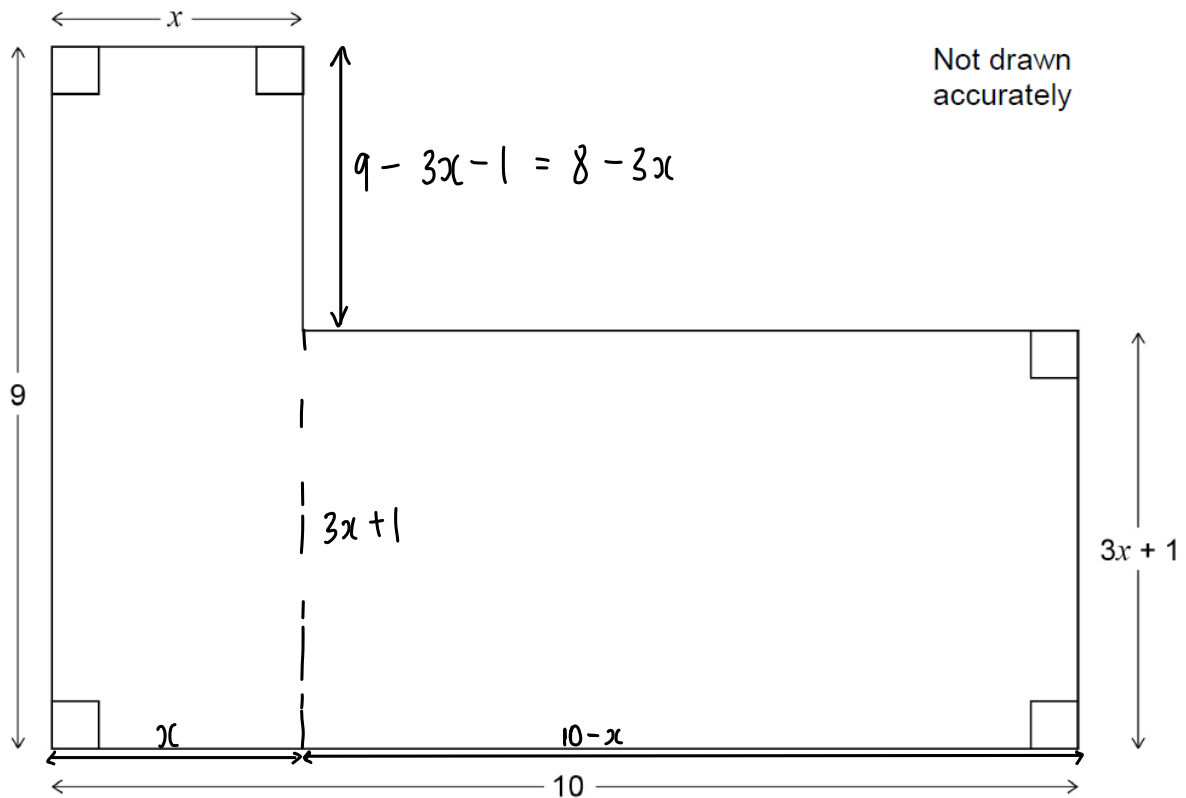
The area of the L-shape is 65 cm$^2$

Work out the value of $x$.

**(Total 6 marks)**

$(10 - x)(3x + 1) + 9(x) = 65$

$30x + 10 - 3x^2 - x + 9x = 65$

$38x - 3x^2 = 55$

$\Rightarrow \quad 3x^2 - 38x + 55 = 0$

$\Rightarrow \quad (x - 11)(3x - 5) = 0$

$x = 11 \quad$ or $\quad x = \dfrac{5}{3}$

not correct as if x=11 the area of the
$\quad$ (10-x)(3x+1) rectangle would
$\qquad$ be negative

$A = 9x + (10 - x)(3x + 1)$

$9\left(\dfrac{5}{3}\right) + \left(10 - \dfrac{5}{3}\right)\left(3\left(\dfrac{5}{3}\right) + 1\right)$

$15 + \left(\dfrac{25}{3}\right)(6) = 65$

hence $x = \dfrac{5}{3}$