GCSE   MATHEMATICS

S21-C300

Non-Calculator Assessment Resource Q

Higher Tier

Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

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

$$v^2 = u^2 + 2as$$

1. Lena makes a fruit drink by mixing orange juice, pineapple juice and sparkling water in the ratio

orange : pineapple : water = 3 : 2 : 7.

(a) What fraction of the mix is water? [1]

$$3 + 2 + 7 = 12$$

$$\frac{7}{12}$$

(b) Lena pours 300 ml of her fruit drink into a glass.

How much pineapple juice is in Lena's glass? [2]

$$\frac{2}{12} = \frac{1}{6}$$

$$\frac{1}{6} \times 300 = 50$$

50 ml

2.

Use:
$$\text{Pressure} = \frac{\text{Force (N)}}{\text{Area (cm}^2)}$$

A camera is attached to a tripod.
The tripod has 3 legs and stands on horizontal ground.
Each leg exerts the same pressure on the ground.

The tripod has a weight of 34 N.
The camera has a weight of 20 N.

Each foot of the tripod is a rectangle with length 3 cm and width 2 cm.

Work out the pressure exerted by the tripod and camera on the ground.
You must show all your working.   [5]

20N
34 N
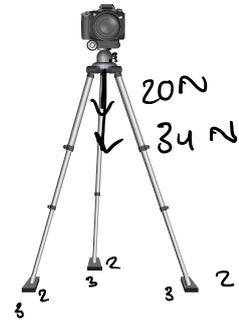
Force = 34 + 20 = 54 N

foot of tripod = 3×2 = 6 cm

3 feet = 6 × 3 = 18 cm

Pressure = $\frac{54}{18}$ = 3

1 × 18 = 18
2 × 18 = 36
3 × 18 = 54

Pressure = ...3...... N/cm²

3. *(a)* Eric currently spends £36 each week playing ten pin bowling.

He wants to decrease this amount by $\frac{3}{8}$.

He writes:

New amount : Current amount
3 : 8
13.50 : 36

I will now spend £13.50 each week playing ten pin bowling

(i) Explain why Eric's **method** is not correct. [1]

he wants to decrease to $\frac{3}{8}$ of 36 and not by $\frac{3}{8}$, so he wants to do 36 − 13.50, which is $\frac{5}{8}$

(ii) Describe what Eric's **answer** of £13.50 actually represents. [1]

it represents $\frac{3}{8}$ of £36

(b) Three integers a, b and c are in the ratios

$$a : b = 9 : 2 \quad \text{and} \quad b : c = 6 : 7.$$

It is known that $a + b + c = 200$.

Find the integers a, b and c. [3]

b : 2 = 6 (×3)
a : b : c = 27 : 6 : 7

a : $\frac{27}{40}$ × 200 = 135

b : $\frac{6}{40}$ × 200 = 30

c : $\frac{7}{40}$ × 200 = 35

$a =$ *135* $b =$ *30* $c =$ *35*

4. (a) (i) $xy = 1$

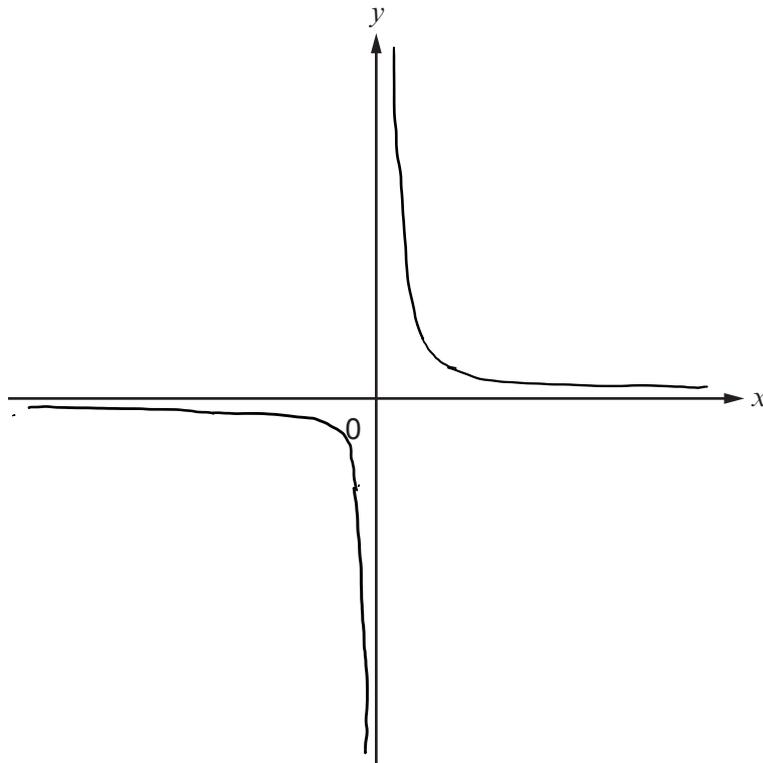Explain why neither x nor y can be zero.   [1]

because if $x = 0$ then $xy = 0y = 0$ not 1
and if $y = 0$ then $xy = x0 = 0$ not 1 so
it is not possible

(ii) On the axes below, sketch the graph of $y = \dfrac{1}{x}$.   [2]

(iii) Complete this sentence about the graph you have drawn.   [1]

The graph shows 'y is __inversely__ proportional to x'.

(b) The variables V and p are connected by the equation $\dfrac{V}{p^2} = 5$.

Find the value of V when $p = 0.1$.   [2]

$\dfrac{V}{0.1^2} = 5 \longrightarrow V = 5(0.01)$

$V = 0.05$

5. *(a)* Solve $10(x-1)-(7x+9)=x$. [3]

$$10x - 10 - 7x - 9 = x$$
$$3x - 19 = x$$
$$2x - 19 = 0$$
$$2x = 19$$
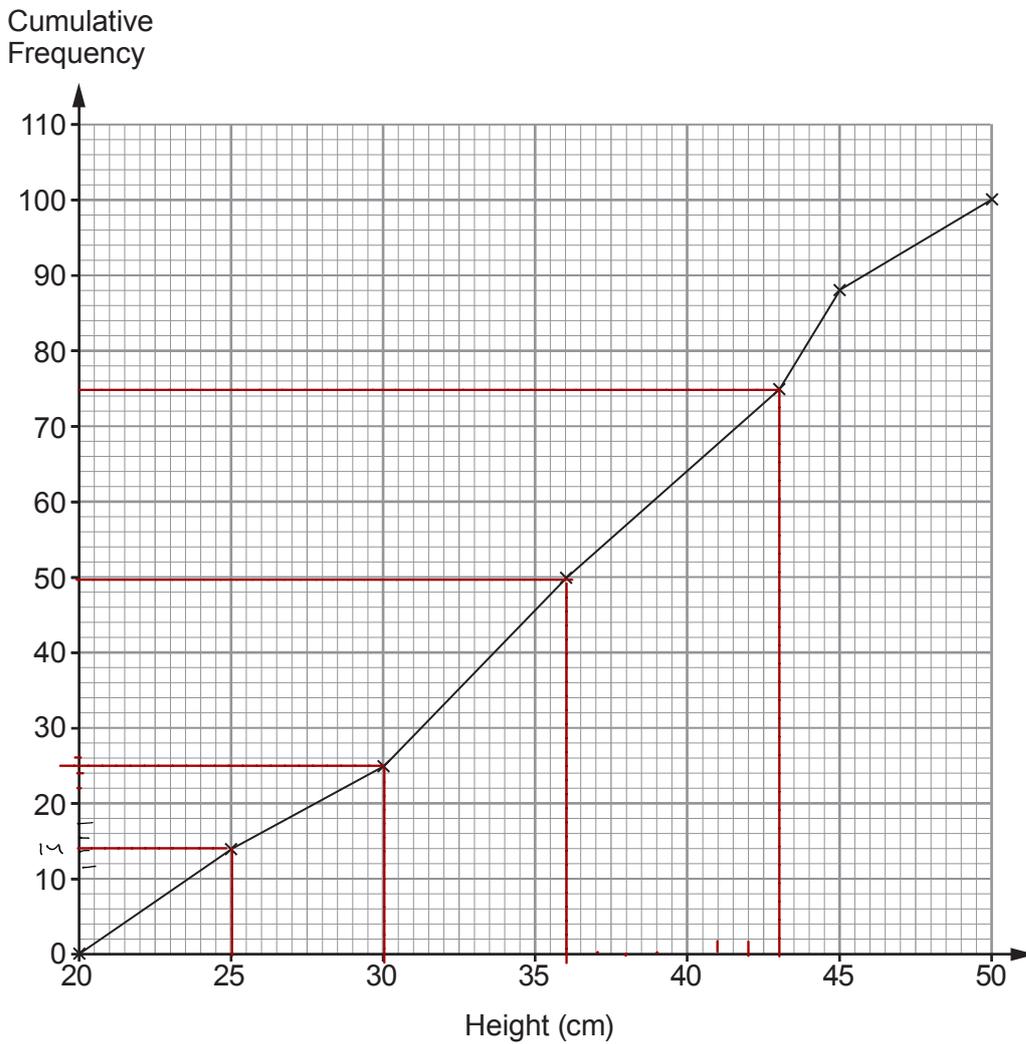$$x = \frac{19}{2}$$

(b) Factorise and hence solve $x^2+3x-18=0$. [3]

$$(x-3)(x+6) = 0$$
$$x = 3 \text{ or } x = -6$$

6. *(a)* The diagram shows the distribution of the heights, in cm, of 100 *Firebird Marigold* plants.

Cumulative Frequency / Height (cm)

(i) How many of these *Firebird Marigold* plants had a height of less than 25 cm? [1]

14 plants

(ii) Use the diagram to complete the table for these *Firebird Marigold* plants. [3]

Median	Lower Quartile	Upper Quartile	Inter-quartile Range
36 cm	30 cm	43 cm	13 cm

(b) This box plot shows the distribution of the heights, in cm, of 100 *Marvel Marigold* plants.

Marvel Marigolds

Firebird Marigolds
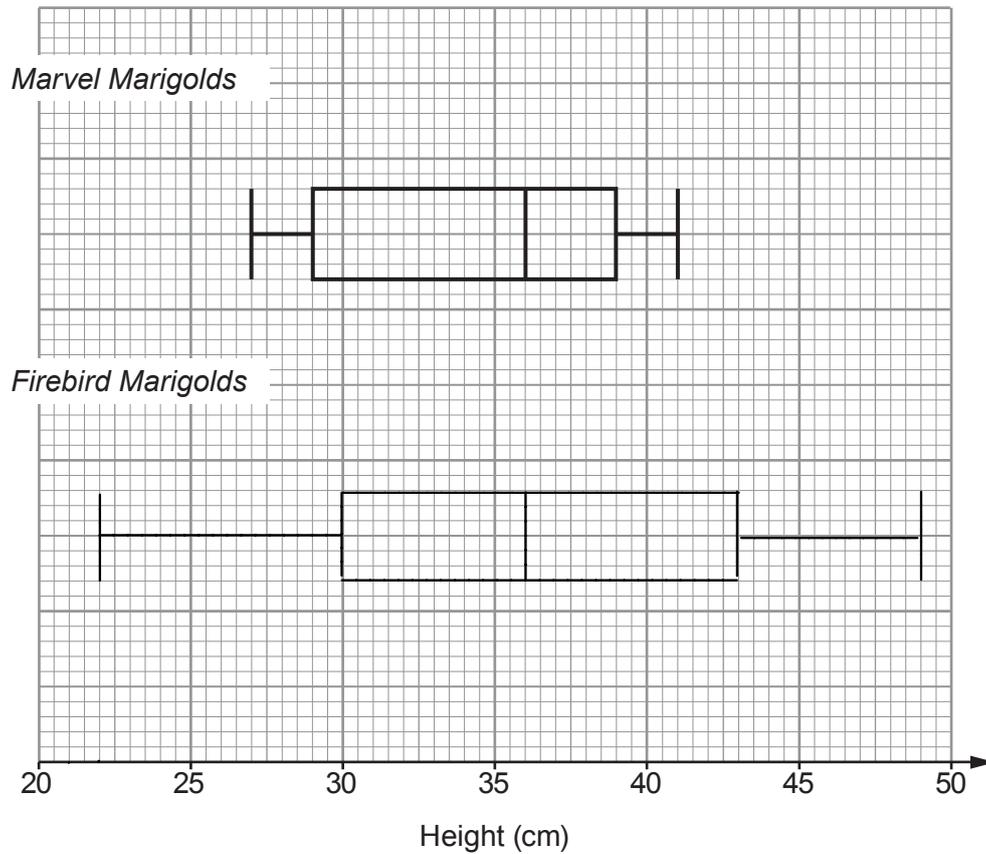
Height (cm)

(i) The tallest *Firebird Marigold* plant had a height of 49 cm.
The range of the heights of the *Firebird Marigold* plants was exactly 27 cm.

Use this information and the information from part *(a)* to draw the box plot for the *Firebird Marigold* plants on the grid above. [2]

49 – 27 = 22

(ii) Jules wants to buy one of these types of Marigold for her garden.
She wants as many as possible of her plants to be at least 30 cm tall.

Should Jules buy *Marvel Marigold* or *Firebird Marigold* plants?
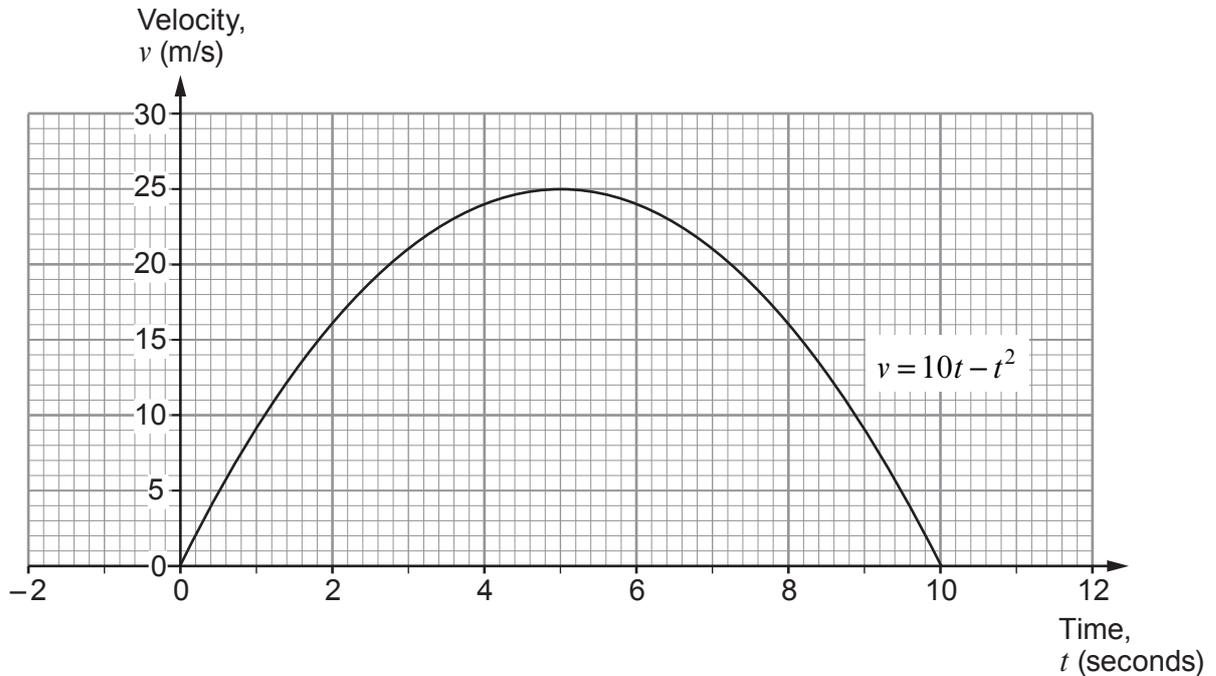
Marvel Marigold ☐   Firebird Marigold ☑

Give a reason for your decision.   percentage of   [1]

As there are more ✓ firebird marigold
plants ∧larger than 80 cm.
    that are

7. The velocity, v m/s of a particle, t seconds after it begins to move is given by

$$v = 10t - t^2 \text{ for } 0 \leqslant t \leqslant 10.$$

  (a)   The diagram shows the graph of the velocity of this particle.

  Find an estimate for the acceleration of the particle at $t = 6$.   [3]
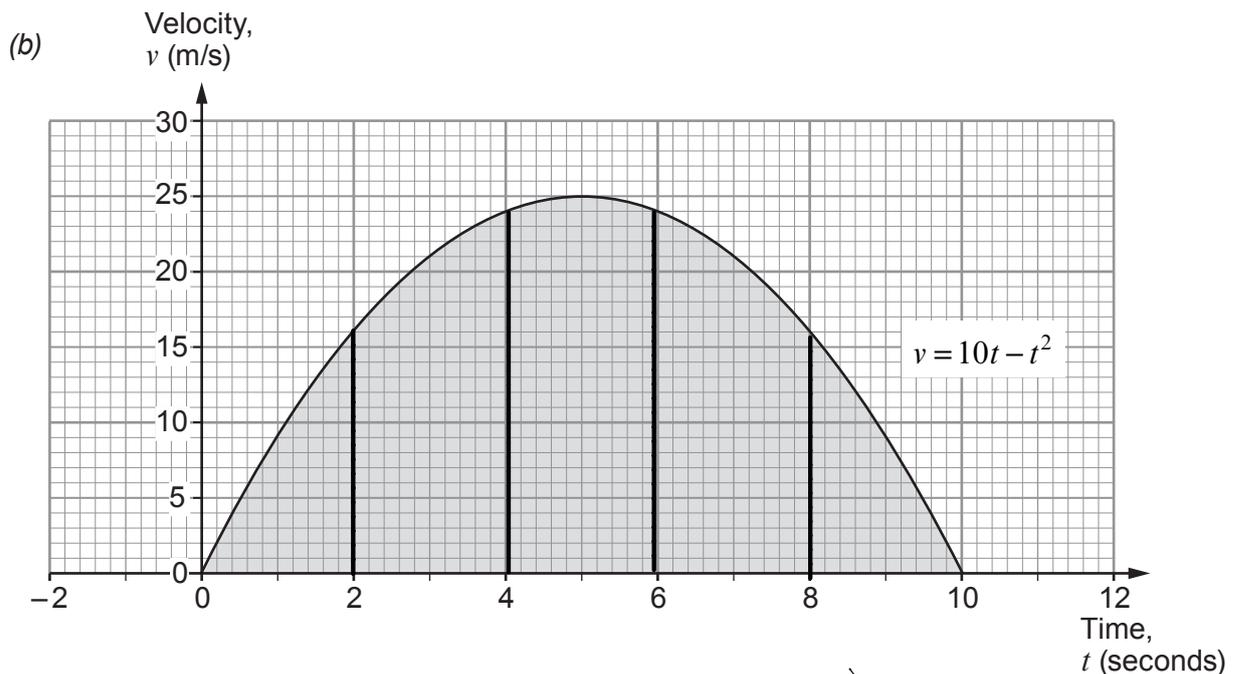
$$V = 10\,(6) - 6^{\,2}$$
$$V = 60 - 36$$
$$V = 24$$

Between $t = 5$ & 6
$$V = u + at$$
$$24 = 25 + a$$
$$a = -1\,ms^{-2}$$

(b)

Velocity, v (m/s)

$v = 10t - t^2$

Time, t (seconds)

(i) Use five vertical strips of equal width to calculate an estimate of the area of the shaded region. [4]

Strip 1: $\frac{1}{2} \times 2 \times 16 = 16$

2: $\frac{1}{2}(16 + 24) 2 = 40$

3: $28 \times 2 = 50$

4: $\frac{1}{2}(24 + 16) 2 = 40$

5: $\frac{1}{2} \times 2 \times 16 = 16$

area $\approx$ 16 + 40 + 50 + 40 + 16

= 32 + 80 + 50

= 82 + 80

= 162

(ii) What does this area represent? [1]

The distance travelled