GCSE (9-1) Mathematics

J560/06 Paper 6 (Higher Tier)

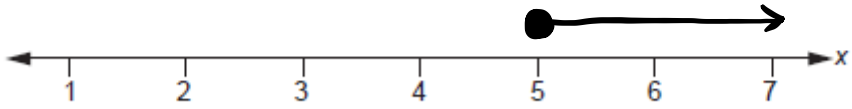
Question Set 3

1 Solve $3x - 5 \geqslant 10$.
Show your solution on the number line.

$3x - 5 \geqslant 10$

$3x \geqslant 15$

$x \geqslant 5$



[4]

2 Kay invests £1500 in an account paying 3% **compound** interest per year.
Neil invests £1500 in an account paying r% **simple** interest per year.

At the end of the 5th year, Kay and Neil's accounts both contain the same amount of money.

Calculate r.
Give your answer correct to 1 decimal place.

$£1500 \times (1.03)^5 = £1738.91$

$£1500 + \left(1500 \times \frac{r}{100}\right) \times 5 = 1738.91$

$\left(1500 \times \frac{r}{100}\right) \times 5 = 238.91$

$1500 \times \frac{r}{100} = 47.782$

$r = 3.185\%$

or $\left(1500 \times \left(1 + \frac{r}{100} \times 5\right) = 1738.91\right)$

$r =$ 3.2% [6]

3 The table shows the children nominated to win the subject prize in Mathematics and the subject prize in English.

Mathematics	English
Alice	Alice
Ben	Claire
Emma	Gabi
Paddy	Simon

The winner of each subject prize is picked at random.
It is possible for Alice to win both prizes.

In what percentage of the combinations of prize winners does Alice win **at least** one prize?

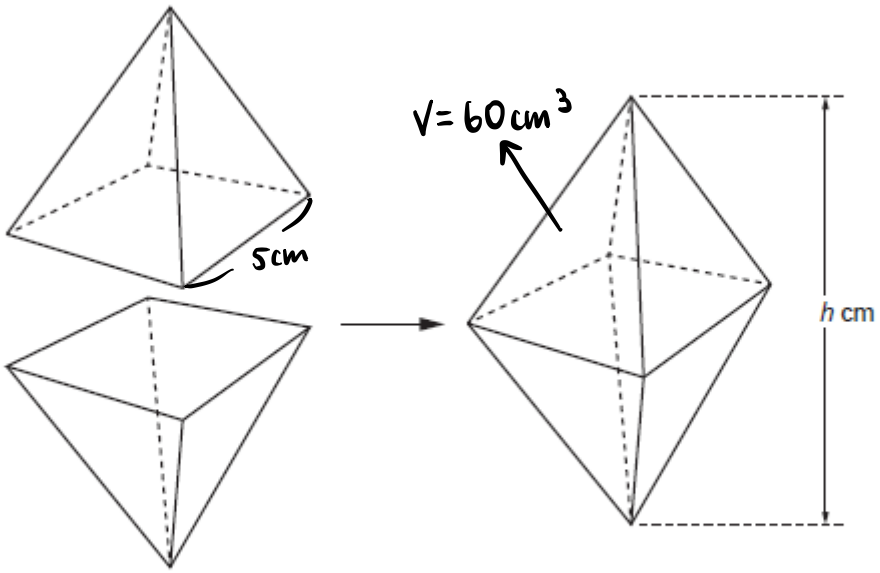
$4 + 4 + 4 + 4 = 16$ = total number of combinations

7 combinations include Alice

$\frac{7}{16} \times 100 = 43.75\%$

43.75 ..... % **[4]**

4 An octahedron is formed from two identical square based pyramids.
The square bases are stuck together as shown.



The volume of the octahedron is 60 cm^3.
The length of the side of each pyramid's square base is 5 cm.

Work out the height h cm of the **octahedron**.

[The volume of a pyramid is $\frac{1}{3}$ × area of base × perpendicular height]

Volume of octahedron:

$\frac{1}{3} \times 5^2 \times h \times 2 = 60$

$h = 60 \times 3 \times \frac{1}{2} \times \frac{1}{5^2}$

$h = \frac{18}{5}$ = height of pyramid

height of octahedron = $2h = \frac{18}{5} \times 2 = \frac{36}{5} = 7.2$

$h =$ 7.2 cm **[4]**

5 (a) Vector $\mathbf{a} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ and vector $\mathbf{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$.

$\begin{pmatrix} x \\ y \end{pmatrix}$

(a) Find the values of k and n so that

$$k(\mathbf{a} + \mathbf{b}) = \begin{pmatrix} 10 \\ n \end{pmatrix}.$$

$k\left\{\begin{pmatrix} 3 \\ -1 \end{pmatrix} + \begin{pmatrix} 1 \\ 3 \end{pmatrix}\right\} = \begin{pmatrix} 10 \\ n \end{pmatrix}$

$k\begin{pmatrix} 4 \\ 2 \end{pmatrix} = \begin{pmatrix} 10 \\ n \end{pmatrix}$

$k \times 4 = 10$ $\quad k = \frac{5}{2}$

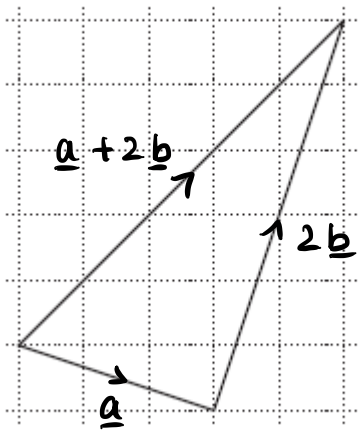
$k \times 2 = n$ $\quad \frac{5}{2} \times 2 = n$

$n = 5$

(a) $k =$ $\frac{5}{2}$

$n =$ 5 [3]

5 (b) **(b)** Gavin starts to draw a diagram to show that $\mathbf{a} + 2\mathbf{b} = \begin{pmatrix} 5 \\ 5 \end{pmatrix}$.



Complete Gavin's diagram. [3]

6 (a) i A sequence is defined by the rule $u_{n+1} = 5u_n - 15$.

(a) If $u_3 = 6$, calculate

(i) u_5

$u_{3+1} = 5u_3 - 15$

$u_4 = 5 \times 6 - 15 = 15$

$u_{4+1} = 5u_4 - 15$

$u_5 = 5 \times 15 - 15$

$u_5 = 60$

(a)(i) $u_5 =$ 60 [3]

6 (a) ii (ii) u_2

$u_{2+1} = 5u_2 - 15$

$u_3 = 6 = 5u_2 - 15$

$5u_2 = 21$

$u_2 = 4.2$

(ii) $u_2 =$ 4.2 [3]

6 (b) (b) Trevor says

If $u_1 = 3.75$ then $u_{100} = 3.75$

Show that Trevor is correct. [2]

$5 \times 3.75 = 18.75$

$18.75 - 15 = 3.75$

Even though n increases, u always gives 3.75 thus u_{100} would also be 3.75.

7 Write $\left(\sqrt[4]{8}\right)^5$ as a power of 2.

$\left(8^{\frac{1}{4}}\right)^5 = 8^{\frac{5}{4}} = \left(2^3\right)^{\frac{5}{4}} = 2^{\frac{15}{4}}$

$2^{\frac{15}{4}}$ [3]

8 (a) The histogram shows information about the weights of some of the parcels handled by a delivery company in one month.

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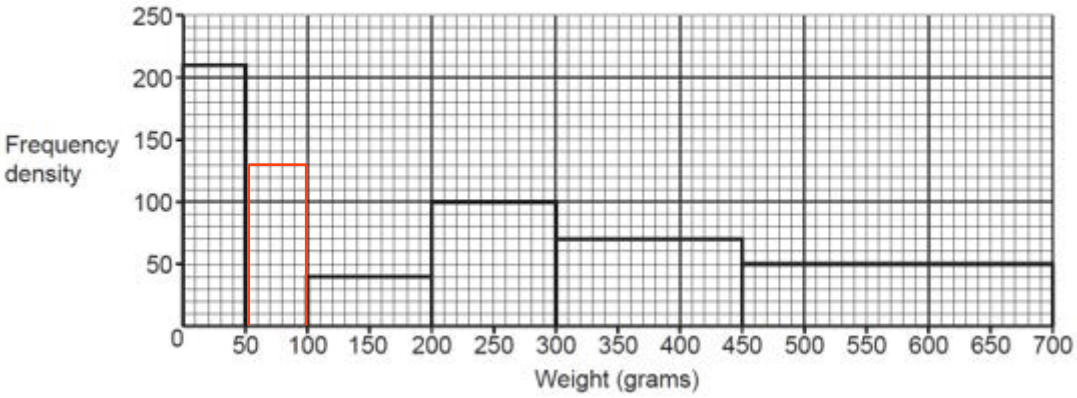


(a) Zoe says

> There are fewer parcels weighing between 450g and 700g than parcels weighing between 300g and 450g.

Is Zoe correct?
Show how you decide.

Between 450g - 700g, there are 12500 parcels (250x50) while between 300g - 450g, there are 10500 parcels (150x70). 12500 > 10500 thus Zoe is incorrect. [4]

8 (b) (b) The delivery company delivered 6500 parcels weighing between 50g and 100g.

Complete the histogram to show this information. [2]

$$\text{frequency density} = \frac{6500}{100-50} = \frac{6500}{50} = 130$$

8 (c) (c) Zoe uses the histogram to calculate the number of parcels weighing between 200g and 250g.

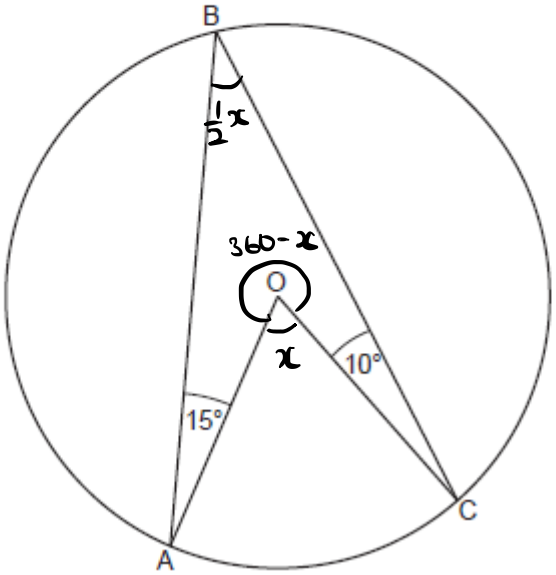
Explain why Zoe's answer is unlikely to be reliable.

Because the weight of the parcels within each group are not evenly distributed within the group. [1]

9 (a)

(a) In the diagram,

- A, B and C are points on the circumference of a circle
- O is the centre of the circle
- angle OAB = 15°
- angle BCO = 10°.



Not to scale

Calculate the acute angle AOC.

$360 = (360 - x) + \frac{1}{2}x + 15 + 10$

$-\frac{1}{2}x + 25 = 0$

$\frac{1}{2}x = 25 \quad (\times 2)$

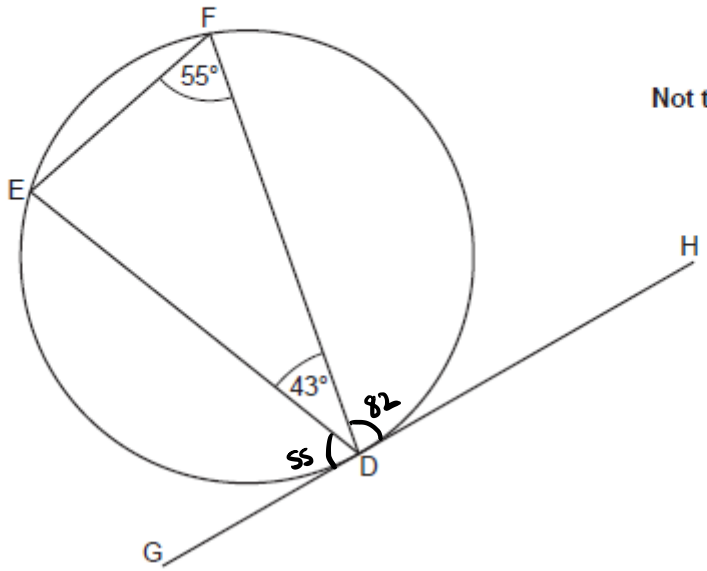
$x = 50°$

(a) 50 ..... ° **[4]**

9 (b)

(b) In the diagram,

- E, F and D are points on the circumference of the circle
- G, D and H lie on a tangent to the circle
- angle EFD = 55°
- angle FDE = 43°.



Not to scale

Explain why angle HDF is 82°.

According to alternate segment theorem ∠EFD is equal to ∠EDG. If we subtract 55° (∠EDG) and 43° (∠EDF) from 180°, we get 82° for ∠HDF.

[4]

Total Marks for Question Set 3: 50

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