Eduqas - H- Nov '23 - C1 -NC

Examiner only

1. Ivy mixes lemon juice, pineapple juice and orange juice in the ratio 1 : 2 : 7 to make a fruit drink.
Ivy has 330 ml of her fruit drink in a glass.

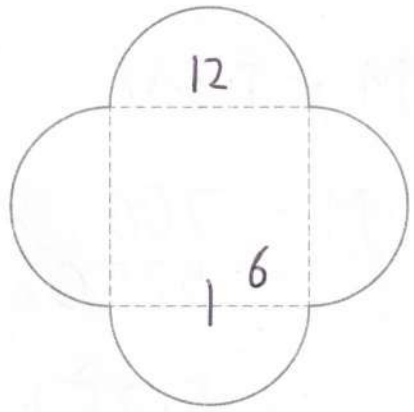
L P O

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

$P = \frac{2}{10}$ $\frac{1}{10} = 33$ 33×2

66 ml

2. The shape below consists of a square surrounded by four semi-circles.
The diameter of each semi-circle is 12 cm.



□ $= 12 \times 12$
$= 144$

Diagram not drawn to scale

Work out the area of the shape.
Give your answer in the form $a + b\pi$. [4]

$4 \times$ ⌓ $= 2 \times$ "O" $= \pi \times 6^2 \times 2$

$= 72\pi \text{ cm}^3$

Area = $144 + 72\pi$ cm^2

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3. Izaan has a block of stainless steel with volume 700 cm^3.
The stainless steel has a density of 7·5 g/cm^3.

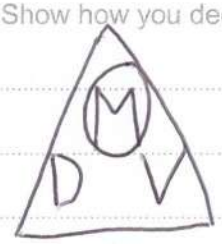
Izaan says,

The block has a mass of less than 5 kg.

Is Izaan correct? [3]

☐ Yes ☑ No ☐ Cannot tell

Show how you decide.



$M = D \times V$

$M = 700 \times 7 \cdot 5$

$= 5250\,g$

$= 5 \cdot 25\,kg$

$5 \cdot 25 > 5$

75
×37
525

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4. Oliver and Kian bake cakes.

The mass of Oliver's cake is between 400 g and 500 g inclusive.
The mass of Kian's cake is between 200 g and 300 g inclusive.

Complete the inequality to show the least and greatest possible differences between the mass of their cakes. [2]

$$\frac{100}{400-300} \leqslant \text{mass difference} \leqslant \frac{300}{500-200}$$

5. Jen is mixing some paints to make brown paint.

She made orange paint by mixing red paint and yellow paint.
40% of the orange paint was red paint.

She then mixes the orange paint with some blue paint in the ratio 20 : 21 to make brown paint.

What fraction of the brown paint is red paint? [3]

Brown

$\frac{20}{41}$ Orange — Blue $\frac{21}{41}$

Red $\frac{4}{10}$ Yel

$$R = \frac{20}{41} \times \frac{4}{10} = \frac{8}{41}$$

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6. The diagram below shows an **equilateral triangle** and a square.

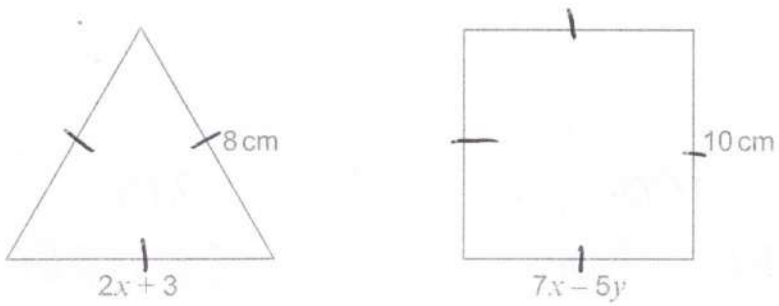

Diagram not drawn to scale

Use an algebraic method to find the value of x and the value of y.
You must show all your working. [5]

$2x + 3 = 8$

$2x = 5$

$x = 2.5$

$2.5 \times 3 = 7.5$ *

$7x - 5y = 10$

$17.5 - 5y = 10$

$7.5 = 5y$

$y = 5 \overline{)7.5}$ $\quad 1.5$

$x = 2.5$

$y = 1.5$

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7. (a) Simplify $7\sqrt{2} \times 3$ [1]

$= 21\sqrt{2}$

(b) Complete the calculation below.

$2\sqrt{11} \times \ldots\sqrt{11}\ldots = 22$ [1]

8. Factorise $3xy^2 + 6x^2y$ [3]

~~$x(y)(y)$~~ ~~$x(x)(y)$~~ $3xy(y + 2x)$

9. Hans thinks of a number.
When his number is multiplied by $2{\cdot}4 \times 10^5$, the answer is $9{\cdot}6 \times 10^8$.

What number did Hans think of?
Write your answer in standard form. [2]

$\frac{9{\cdot}6 \times 10^8}{2{\cdot}4 \times 10^5}$

$9{\cdot}6 \div 2{\cdot}4 = 4$
$10^8 \div 10^5 = 10^3$

$= \underline{\underline{4 \times 10^3}}$

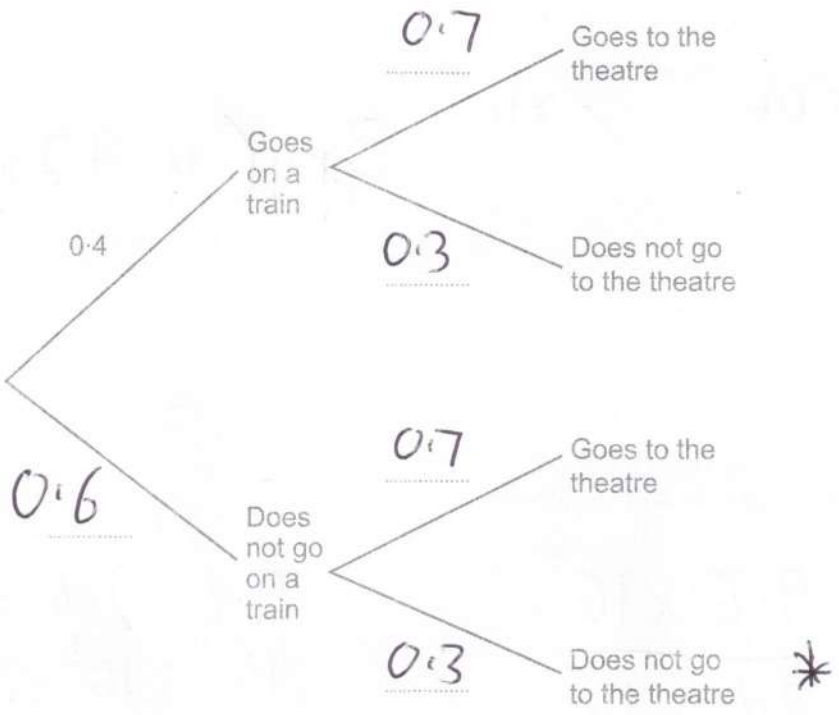
Examiner only

10. Kate is visiting London.

The probability that she will go on a train is 0·4.
The probability of Kate going to the theatre is independent of her going on a train.

The probability that she goes on a train and goes to the theatre is 0·28.

(a) Complete the following tree diagram. [4]



(b) Calculate the probability that Kate does not go on a train and does not go to the theatre. [2]

$0.6 \times 0.3 = 0.18$

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11. It takes 2 hours to empty 8 identical tanks of water using 9 identical pumps.

How long would it take to empty 2 of these tanks using 3 of these pumps? [3]

$\frac{1}{3}$ of pumps = 3x longer

$\frac{1}{4}$ of tanks = $\frac{1}{4}$ x time to complete

2 x 3 = 6hrs 6 ÷ 4 = 1.5hrs

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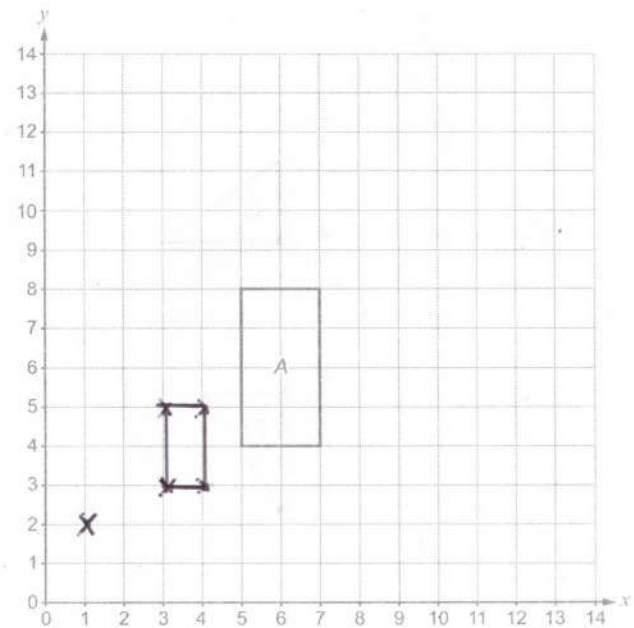
12. (a)



Draw the enlargement of rectangle *A* with scale factor $\frac{1}{2}$ and centre of enlargement (1, 2). [2]

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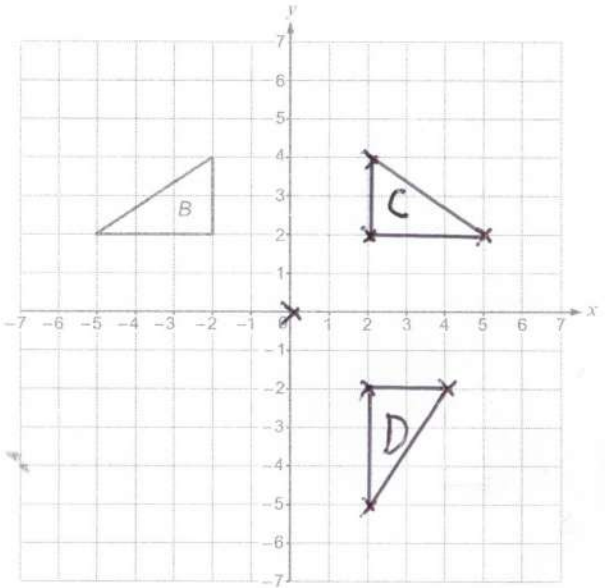
(b)



Triangle B is reflected in the line $x = 0$ to give triangle C.

Triangle C is rotated 90° clockwise about (0, 0) to give triangle D.

(i) Draw triangle C and triangle D. [2]

(ii) Describe the **single** transformation that maps triangle B to triangle D. [1]

Reflection in the line $y = x$

Examiner only

13. (a) Show that the lines

$3y - 12x = 9$ and $2y = 8x - 13$

are parallel to each other. [3]

$3y = 12x + 9$

$y = \underline{\underline{4}}x + 3$

$m = 4$

$y = \underline{\underline{4}}x - 13/2$

$m = 4$

Both have gradient = 4
hence parallel

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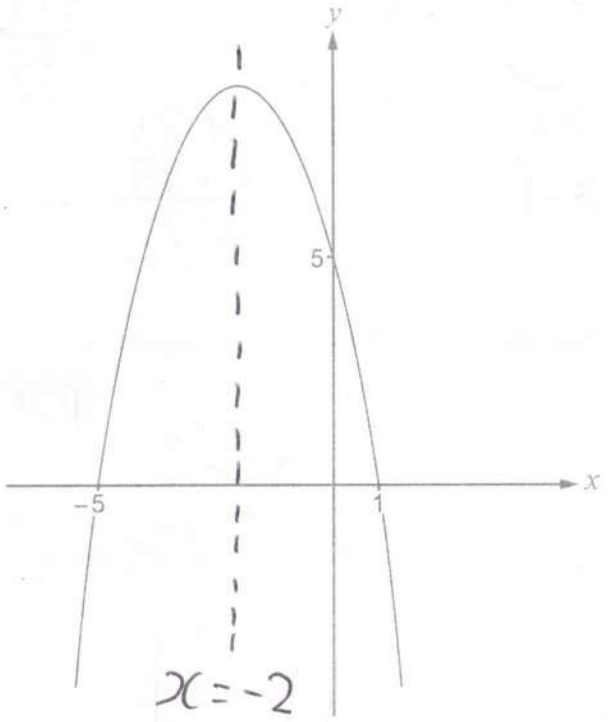
(b) The diagram shows the curve $y = 5 - 4x - x^2$.



Calculate the coordinates of the turning point of the curve. [2]

$\frac{-5+1}{2} = -2$

$y = 5 - 4(-2) - (-2)^2$
$= 5 + 8 - 4$
$= 9$

(-2 , 9)

Examiner only

14. (a) (i) Find the next term in this sequence. [2]

$\frac{5}{2}$ $\quad -\frac{25}{4}$ $\quad \frac{125}{8}$ $\quad -\frac{625}{16}$ $\quad \frac{3125}{32}$

×5, ×2, ×−1

625 × 125 = 3125

(ii) Find the next term in this Fibonacci-style sequence. [1]

10 15 25 40 65 105

+

(b) The nth term of a sequence is $(10\sqrt{5})^n$.

Calculate the 4th term of this sequence.
You must simplify your answer. [2]

$(10\sqrt{5})^4 = 10^4 \times \sqrt{5}^4$

$= 10000 \times 25$

4th term = 250000

Examiner only

(c) Find the nth term of the sequence below. [2]

3 15 35 63 99

12 20 28 36

8 8 8

(÷1) $8 \div 2 = 4$

$4n^2 = 4\ 16\ 36\ 64\ 100$

nth term = $4n^2 - 1$

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Examiner only

15. (a) Factorise $5x^2 + 13x + 6$. [2]

$ac = 30$

$5x^2 + 10x \mid +3x + 6$

$5x(x+2) \mid +3(x+2)$

$= (5x+3)(x+2)$

(b) Adrian is trying to solve $3 - 4x > 11$.
He writes the following:

$3 - 4x > 11$
$-4x > 8$
$x > \frac{8}{-4}$
$x > -2$

Adrian's method is incorrect. Explain why. [1]

When dividing by a negative the inequality should reverse

(c) Simplify $\frac{(x^4)^3}{x^2}$. [2]

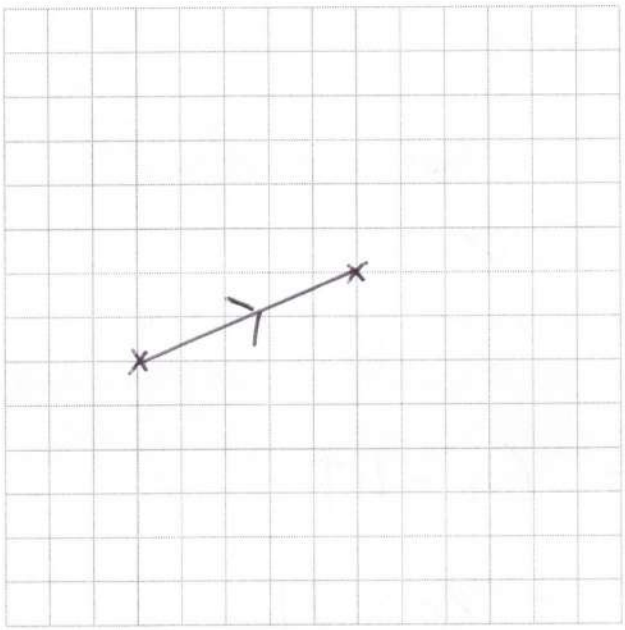
$= \frac{x^{4\times3}}{x^2} = \frac{x^{12}}{x^2} = x^{12-2}$

$= x^{10}$

Examiner only

16. (a) The vector $t = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$ and the vector $w = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$.

On the grid below, draw the vector $t + w$. [2]



$t + w = \begin{bmatrix} 7 \\ -2 \end{bmatrix} + \begin{bmatrix} -2 \\ 4 \end{bmatrix} = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$

Examiner only

(b)

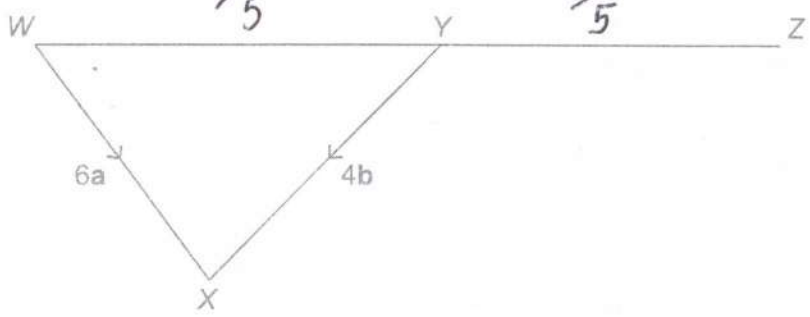


Diagram not drawn to scale

WYZ is a straight line. ✓

The vectors **WX** and **YX** are shown in the diagram. ✓

Given that $WY : YZ = 2 : 3$, write the vector **WZ** in the form $m\mathbf{a} + n\mathbf{b}$. [3]

$\overrightarrow{WY} = 6a - 4b$

$\div 2 \quad = 3a - 2b$

$\times 3 \quad = 9a - 6b$

$WZ = (6a - 4b) + (9a - 6b)$

$= \underline{15a - 10b}$

Examiner only

17. (a) Evaluate $8^{\frac{5}{3}}$. [2]

$= \sqrt[3]{8^5}$

$= 2^5 \quad = 2 \times 2 \times 2 \times 2 \times 2$

$= 32$

(b) Write $\frac{6}{\sqrt{2}}$ in the form $a\sqrt{2}$ where a is an integer. [2]

$\frac{6}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{6\sqrt{2}}{2}$

$= 3\sqrt{2}$

(c) **Estimate** the value of $\frac{(1{\cdot}96 \times 10^8) + (6{\cdot}89 \times 10^8)}{298}$.

Write your answer in standard form. [3]

$= \frac{(2 \times 10^8) + (7 \times 10)^8}{300}$

$= \frac{9 \times 10^8}{3 \times 10^2} \quad = 3 \times 10^6$

Examiner only

18. Lena sold 200 drinks on Saturday.

This table shows some information about these drinks.

	Tea	Coffee	Milkshake	Totals
Small	5	36	$x=20$	61
Medium	18	3	6	27
Large	30	42	$2x=40$ *	112
Totals	53	81	66	200

On that Saturday:

- 15% of the drinks sold were large teas. ✓
- The ratio of the number of medium teas to the number of medium milkshakes sold was 3:1.
- The number of large milkshakes sold was double the number of small milkshakes sold. *

Complete the table above using this information.

One of the drinks is selected at random.
Find the probability that this drink was either a medium tea or a medium coffee. [6]

$\frac{15}{100} \times \frac{200}{1} = 30$

Milkshake
$x + 2x = 66 - 6$
$3x = 60$
$x = 20$

MT : MM :
3 : 1 ×6
18 6

Probability of selecting a medium tea or a medium coffee = $\frac{21}{200}$

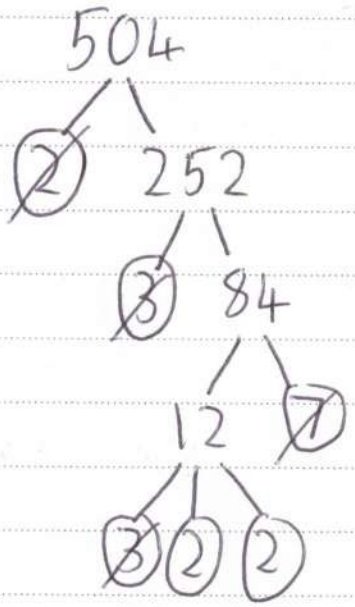
$18 + 3$

Examiner only

19. 1134 can be written as $2 \times 3^4 \times 7$.

2 3 3 3 3 7

(a) Find the highest common factor of 504 and 1134.
Give your answer as an integer. [4]



$$3\overline{)252}\quad 84$$

HCF = 7 x 3 x 3 x 2
= 21 x 6

Highest common factor of 504 and 1134 = 126

(b) What is the smallest whole number 1134 can be divided by to give a square number? [1]

2 x 3^4 x 7 2 x 7 = 14

Examiner only

20. X, Y and Z are points on the circumference of a circle with centre O.

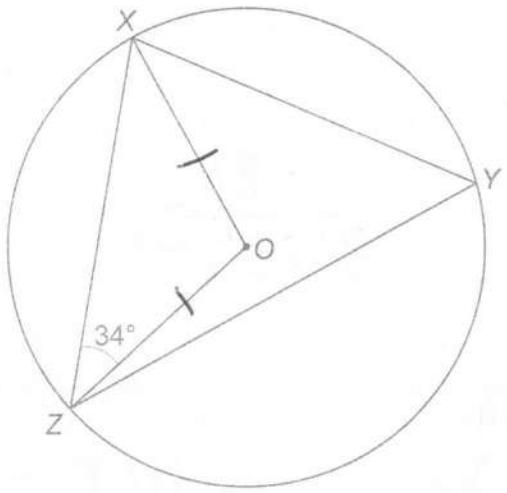


Diagram not drawn to scale

Maia thinks that $X\hat{Y}Z$ is 58°.
Prove that Maia is incorrect.

You must show all your working and give a reason for each step of your proof. [4]

$\angle XOZ = 180 - (34 \times 2) = 112°$

(two radii → base angles of an isosceles triangle are equal)

$\angle XYZ = 112 \div 2 = \underline{\underline{56°}}$

(angle at the centre is twice the angle at the circumference)

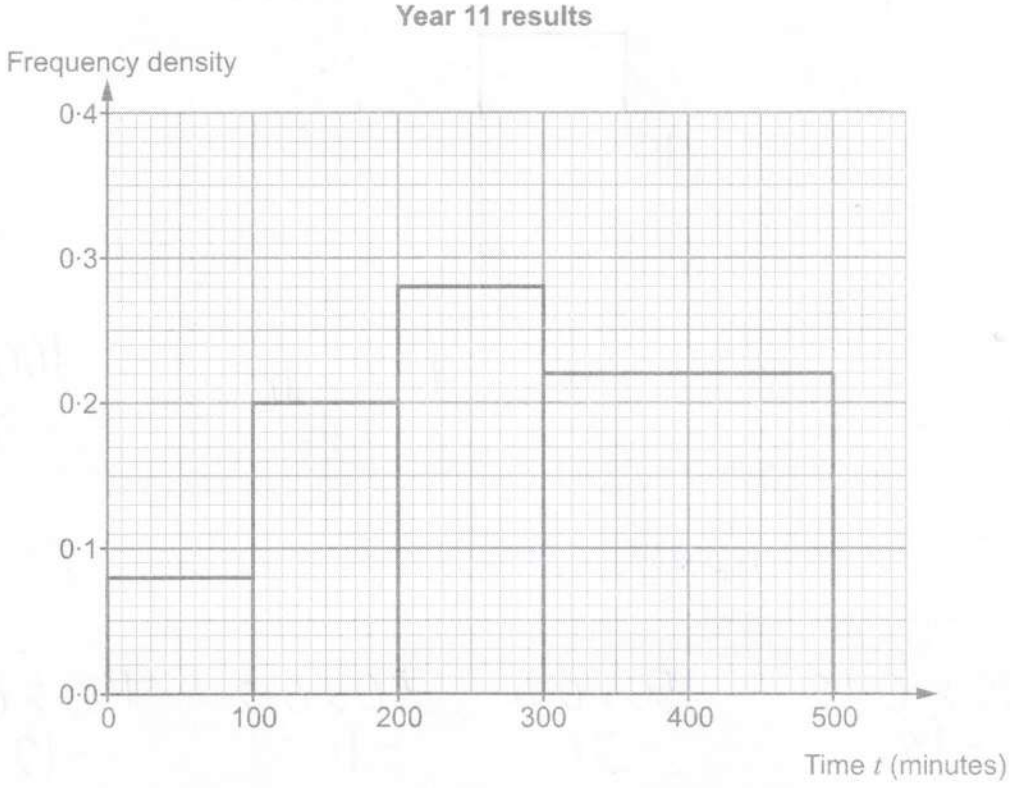
Examiner only

21. Alice is investigating how much time, in minutes, pupils at her school spend on their mobile phones.
She asks 100 students in Year 11 and 100 students in Year 7 to record how much time they each spend on their mobile phones on a Monday.

(a) The results for Year 11 are shown in the table below.

Time t (minutes)	$0 \leqslant t < 50$	$50 \leqslant t < 100$	$100 \leqslant t < 200$	$200 \leqslant t < 300$	$300 \leqslant t < 400$	$400 \leqslant t < 500$
Number of students	3	5	20	28	30	14

Alice displays her results in the histogram shown below.



Give **one** criticism of Alice's histogram. [1]

Grouping the data means some information has bee lost

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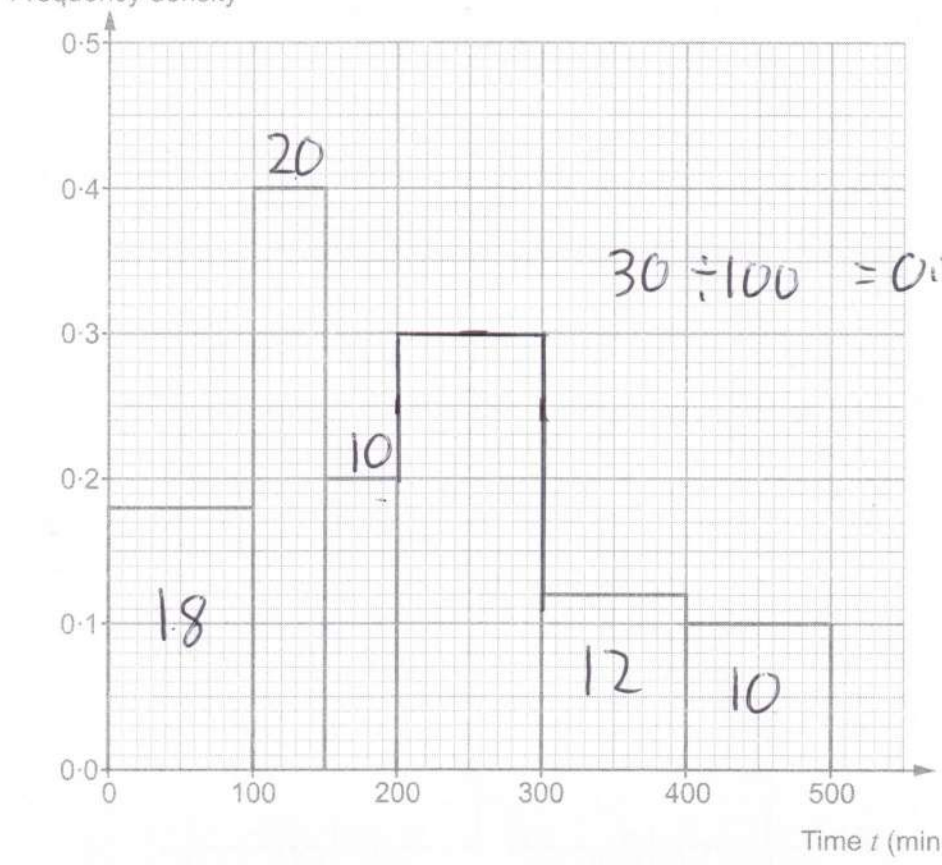
(b) Alice's histogram showing the results for the 100 Year 7 students is shown below.
The group with time $200 \leqslant t < 300$ is missing.

Year 7 results



Complete the histogram.
You must show all your working. [3]

100 x 0·18 = 18 50 x 0·4 = 20 50 x 0·2 = 10 100 x 0·12 = 12

100 - 70 = 30

(c) Make **one** comparison between the amount of time spent on their mobile phones by **all** the students in Year 11 and **all** the students in Year 7. [1]

Y11 students spend more time on their phones than Y7 students

Examiner only

22. The following iterative formula can be used to find the number of cells of bacteria after n days.

$$B_0 = 1000$$
$$B_{n+1} = 1{\cdot}2B_n \text{ where } n \geqslant 0$$

(a) Show that the number of cells of bacteria after 1 day is 1200. [1]

$B_1 = 1{\cdot}2 \times 1000 = 1200$

(b) Use this formula to find the number of cells of bacteria after 3 days. [3]

$B_2 = 1200 \times 1{\cdot}2 = 1440$

$B_3 = 1440 \times 1{\cdot}2 = 1728{\cdot}0$

Number of cells of bacteria after 3 days = 1728

$$\begin{array}{r} 1440 \\ \times\ 12 \\ \hline 17280 \end{array}$$

Examiner only

23. Adina has 5 wooden blocks. Each block is a different colour.

Blue	Red	Green	Yellow	Purple

Adina selects 3 of these wooden blocks at random.
Each time she does this, she places them on top of each other.
Two ways of arranging the blocks are shown below.

Blue
Yellow
Red

Green
Red
Purple

(a) Calculate the number of different ways of arranging the blocks. [2]

$5 \times 4 \times 3 = \underline{60}$

(b) How many arrangements are there where the middle block is **either** blue **or** red? [2]

4 4

B = 1 R = 1

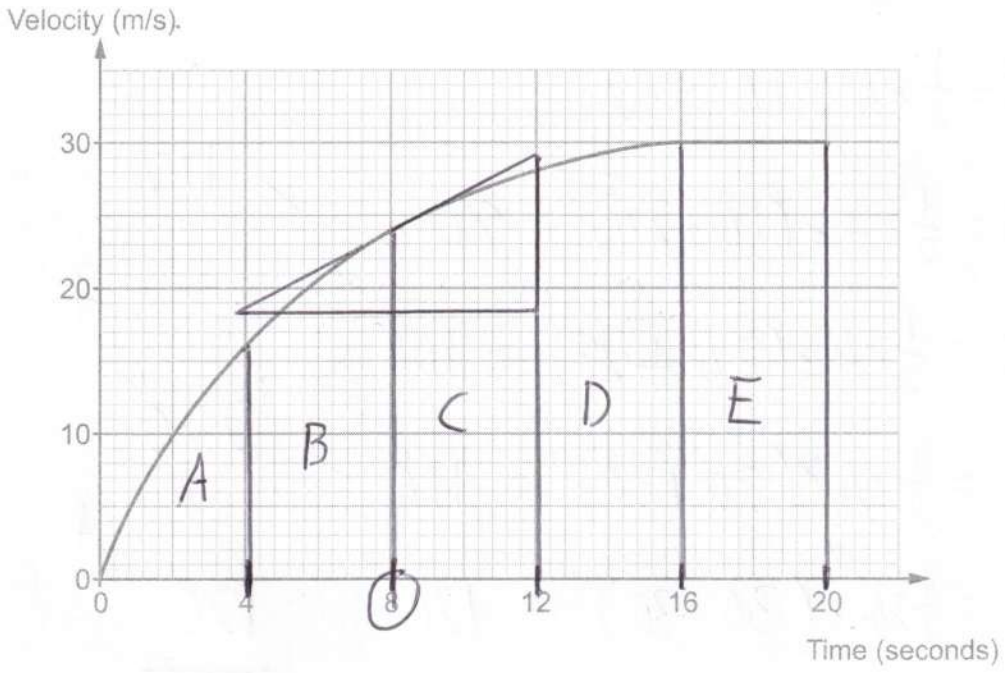
3 3

$(4 \times 1 \times 3) + (4 \times 1 \times 3)$

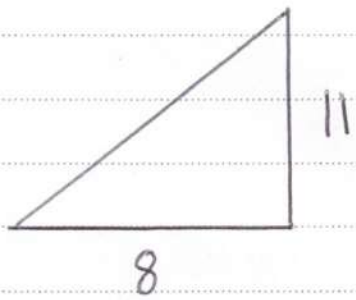
$= \underline{24}$

Examiner only

24. The velocity-time graph below shows the velocity of a car for the first 20 seconds from rest.



(a) Calculate an estimate of the acceleration of the car at time 8 seconds. [3]



$11 \div 8 = 1\frac{3}{8}$

Acceleration = 1·375 m/s^2

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(b) Use 5 vertical strips of equal width to calculate an estimate of the distance travelled by the car during the first 20 seconds of motion. [3]

$A = \frac{1}{2} \times 4 \times 16 = 32$

$B = \frac{1}{2} \times 4 \times (16 + 24) = 80$ } 112

$+$

$C = \frac{1}{2} \times 4 \times (24 + 28) = 104$

$D = \frac{1}{2} \times 4 \times (28 + 30) = 116$ } 220

$+$

$E = \frac{1}{2} \times 4 \times (30 + 30) = 120$ 120

452

Distance travelled = 452 m

Examiner only

25. (a) $h(x) = x^2 + 3$.

Show that $h^{-1}(x)$ has no solutions for $x < 3$. [3]

$y = x^2 + 3$

$y - 3 = x^2$

$\sqrt{y-3} = x$

so $h^{-1}(x) = \sqrt{x-3}$

cannot $\sqrt{-ve}$ so x min $= 3$

(b) $f(x) = x^2 + 5$.
$g(x) = x - 4$.

Show that $fg(x) - gf(x) = 20 - 8x$.
You must show all your working. [4]

$(x-4)^2 + 5 - (x^2 + 5 - 4)$

$= x^2 - 8x + 16 + 5 - x^2 - 1$

$= 16 + 5 - 1 - 8x$

$= 20 - 8x$

Examiner only

26. Make e the subject of the following formula. [5]

$$3e = \sqrt{7 - de^2}$$

$9e^2 = 7 - de^2$

$9e^2 + de^2 = 7$

$e^2(9 + d) = 7$

$e^2 = \frac{7}{9+d}$

$e = \pm\sqrt{\frac{7}{9+d}}$

27. Express $0\dot{3}\dot{4}\dot{5}$ as a fraction. [2]

$x = 0.3\dot{4}\dot{5}$

$10x = 3.\dot{4}\dot{5}$

$1000x = 345.\dot{4}\dot{5}$

$990x = 342$

$x = \frac{342}{990}$ OE

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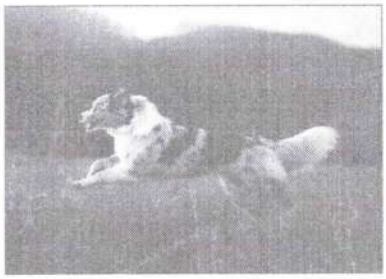
28.



Sofia's dog is running through a field.
Its speed at t seconds is w metres per second.

The diagram below shows the speed of the dog for part of its run.

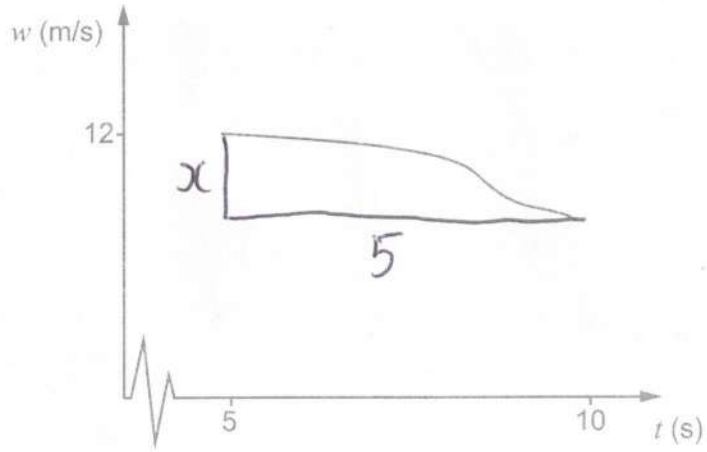


Diagram not drawn to scale

When $t = 5$, $w = 12$.
The average deceleration of the dog between 5 and 10 seconds is $1{\cdot}5\,m/s^2$. =M

Calculate the speed of Sofia's dog when $t = 10$.
You must show all your working. [3]

$x = 5 \times 1{\cdot}5 = 7{\cdot}5$

$12 - 7{\cdot}5$

Speed when $t = 10$ is 4·5 m/s

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