OCR-H Nov'22 P4

Answer **all** the questions.

1 **(a)** Write 65400 in standard form.

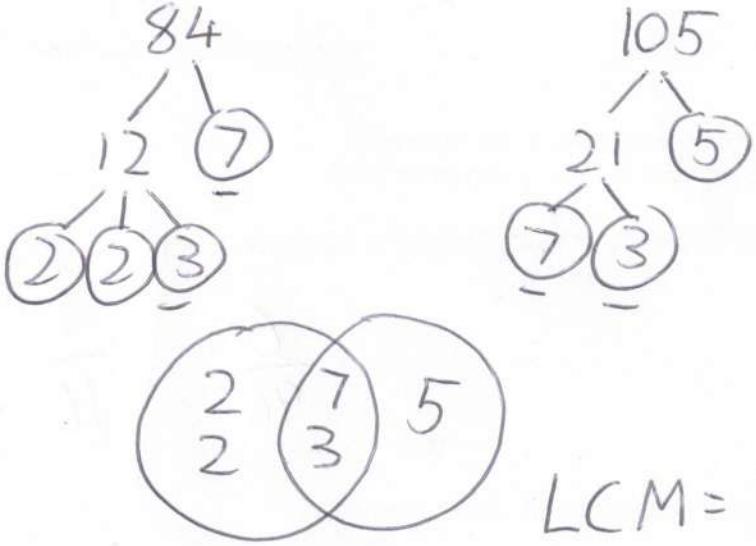
(a) 6.54×10^4 ✓ [1]

(b) Write 8.2×10^{-4} as an ordinary number.

(b) 0.00082 ✓ [1]

2 In 2019, comet A and comet B were both seen from Earth.
Comet A is seen from Earth every 84 years.
Comet B is seen from Earth every 105 years.

Find the next year when both comets will be seen from Earth.



✓ ✓

$LCM = 7 \times 5 \times 3 \times 2^2$
$= 420$ ✓

$2019 + 420 = 2439$ ✓

[4]

3 An examination has three papers.
Paper 1 is marked out of 60.
Paper 2 is marked out of 40.
Paper 3 is marked out of 100.
The three marks are added together to form the total mark out of 200.

A student scored 65% on Paper 1 and 70% on Paper 2.

Find the mark they need to get on Paper 3 to achieve 64% of the total marks.
You must show your working.

✓ $0.65 \times 60 = 39$

✓ $0.7 \times 40 = 28$

✓ $0.64 \times 200 = 128$ needed

✓ $128 - 28 - 39 = 61$ ✓

..... **[5]**

4 A phone manufacturer records the faults that are reported.
Last week, in a batch of 96 phones, 6 were reported as faulty.

(a) Write down the relative frequency of faulty phones in this batch.

$\frac{6}{96}$ | $\frac{1}{16}$ ✓OE

(a) ..... **[1]**

(b) In 2020, the manufacturer sold a total of 12321 phones.

Work out how many of these phones the manufacturer should expect to be reported as faulty.

✓ $\frac{1}{16} \times 12321 = 770$ ✓

(b) ..... **[2]**

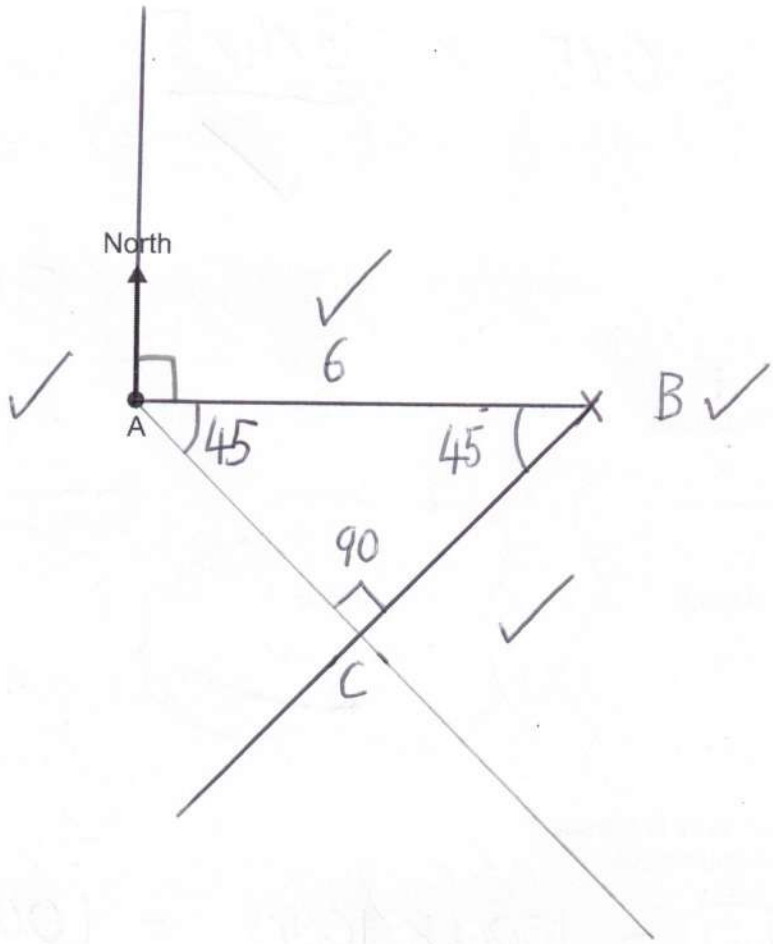
(ms accepts 771)

5 B is 12 km due east of A.
C is south-east of A and on a bearing of 225° from B.

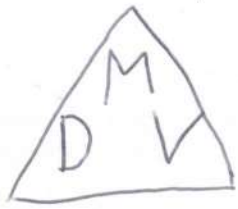
12km = 6cm

Complete the diagram to show the positions of A, B and C.
Show clearly the values of all three angles in triangle ABC.

Scale: 1 cm represents 2 km



[4]



6 **(a)** A solid block of wood is a cuboid which measures 3 cm by 4 cm by 5 cm.
Its density is 0.65 g/cm^3.

Work out the mass of the block of wood.

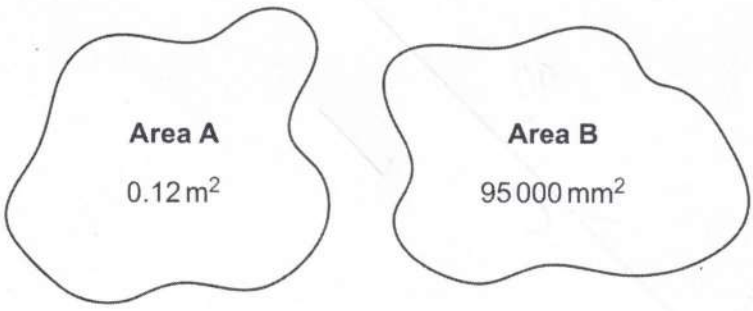
$M = D \times V$

$= 0.65 \times 3 \times 4 \times 5$ ✓

390 ✓

(a) ..... g **[2]**

(b) Here are two areas.



Not to scale

State which area is greater.
Show how you decide.

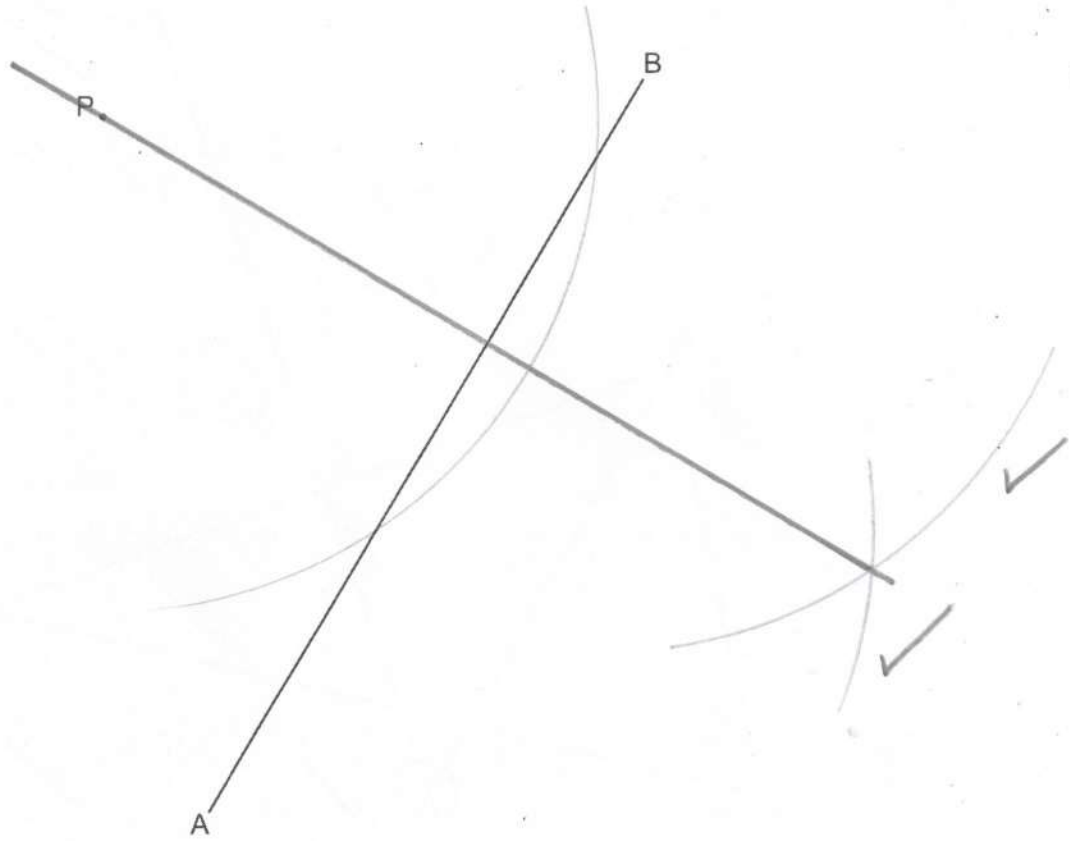
$1\ m^2 = 1000 \times 1000 = 1\,000\,000\ mm^2$

$0.12\ m^2 \times 1000000 = 120\,000\ mm^2$ ✓

Area A is greater because 120000 > 95000 ✓

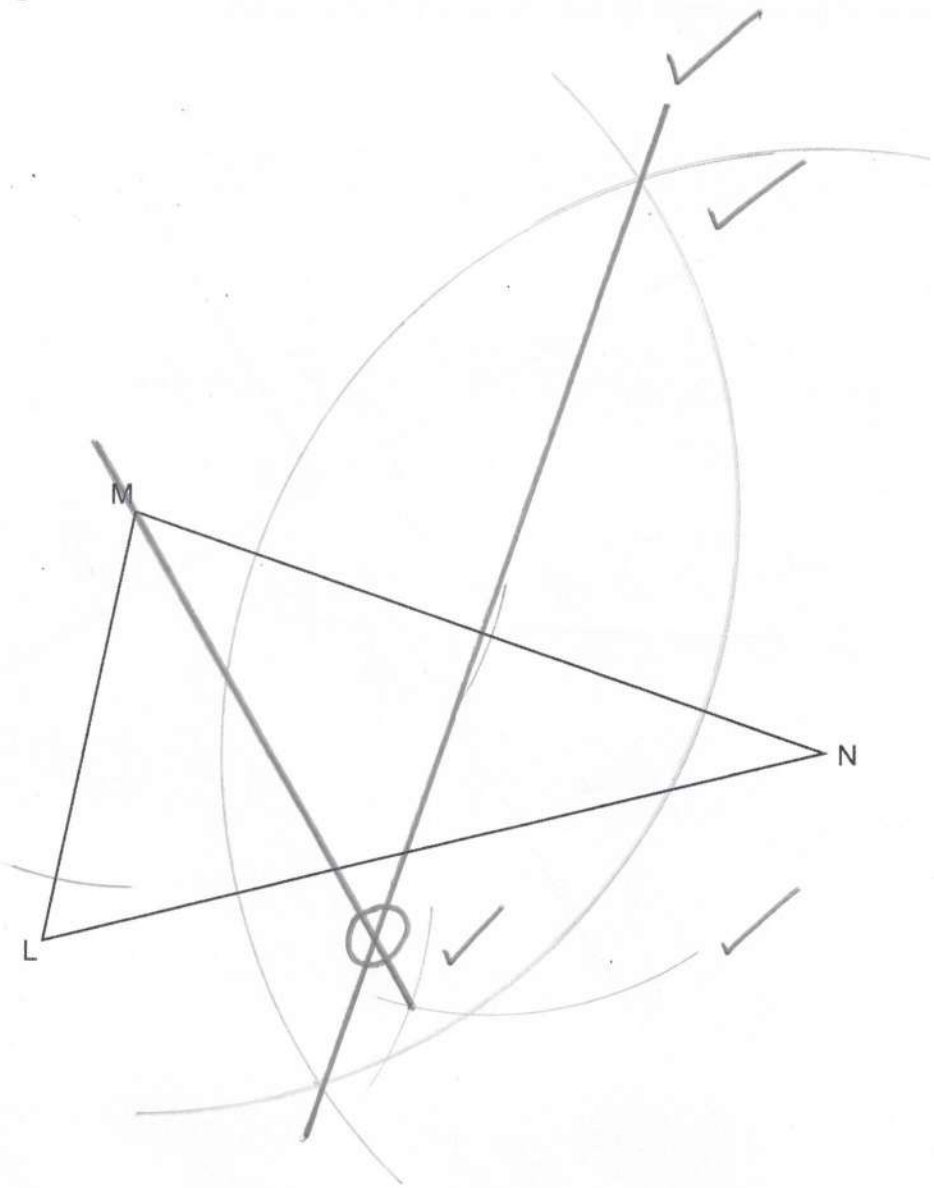
..... **[2]**

7 **(a)** Construct the perpendicular from the point P to the line AB.



[2]

(b) The diagram shows a field LMN.



A tree is to be planted in the field so that it is

- the same distance from the fences MN and ML → ∠ bis. angle M

and

- the same distance from corner M as from corner N. → ⊥ bis.

Show, by construction, whether this can be done or cannot be done.

This cannot be done. **[5]**

8 A bag contains 35 balls.
Each ball is either red or green.
The ratio of red balls to green balls is 3 : 2.

Work out the smallest number of balls of each colour that have to be added to the bag so that the ratio of red balls to green balls becomes 7 : 3.
You must show your working.

R G
3 2

21 14 ✓✓

15 = M3 so +1 ✓✓

35 15
x5 (x5
7 3

Number of red balls added to the bag = 14 ✓

Number of green balls added to the bag = 1 **[5]**

9 Here are two pieces of work.

For each one, describe the error in the method and give the correct answer.

(a)

Question:

Rearrange $y = 3x + 17$ to make x the subject.

Solution:

$y = 3x + 17$

$y + 17 = 3x$

$x = \frac{y + 17}{3}$

Error is the +17 should be -17 ✓

Correct answer $x = \frac{y-17}{3}$ ✓ **[2]**

(b)

Question:

Rearrange $A = 4x^2$ to make x the subject, where $x > 0$.

Solution:

$A = 4x^2$

$\sqrt{A} = \sqrt{4x^2}$

$\sqrt{A} = 4x$

$x = \frac{\sqrt{A}}{4}$

Error is must $\sqrt{4}$ as well ✓

Correct answer $\frac{\sqrt{A}}{2}$ or $\sqrt{\frac{A}{4}}$ ✓ **[2]**

10 You may use these kinematics formulae to answer this question.

$v = u + at$

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

A particle has an initial velocity of 3 m/s.
After 20 seconds the particle has a velocity of 11 m/s.

Work out the distance the particle has travelled after 20 seconds.

$u = 3$
$t = 20$
$v = 11$

$v = u + at$

$a = \frac{v - u}{t}$

$a = \frac{11 - 3}{20} = \frac{2}{5}$ ✓✓

$a = \frac{2}{5}$
$u = 3$
$t = 20$

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

$s = 3 \times 20 + \frac{1}{2} \times \frac{2}{5} \times 20^2$ ✓

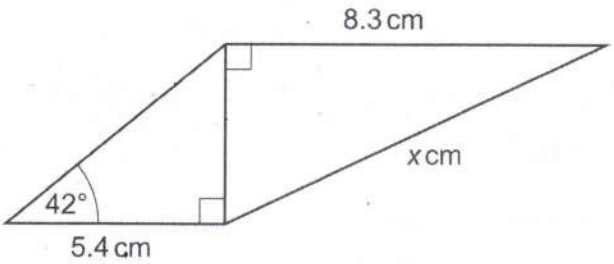
$s = 60 + 80$

140 ✓

..... m **[4]**

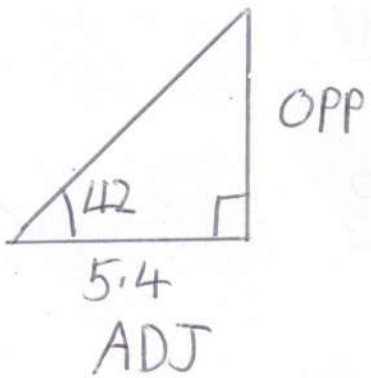
11 The diagram shows two right-angled triangles that are joined together.

All measurements are given accurate to 2 significant figures.



Not to scale

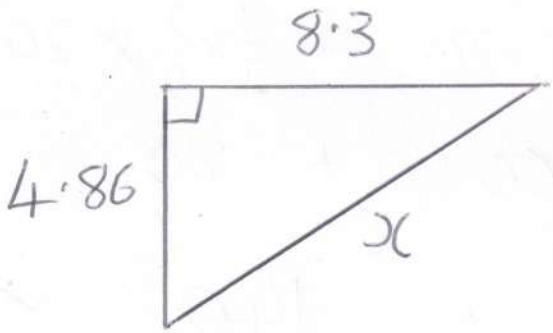
Work out the value of x.
Give your answer correct to an appropriate degree of accuracy.
You must show your working.



TOA

opp = tan 42 × 5.4 ✓✓

= 4.86... ✓

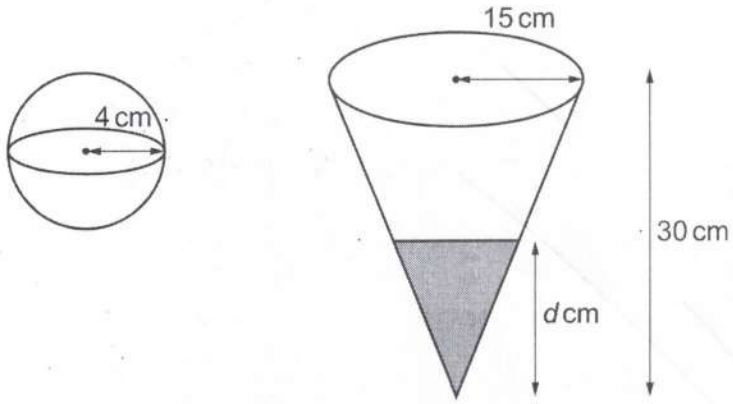


$x = \sqrt{8.3^2 + 4.86^2}$ ✓✓

9.6 cm ✓

$x =$ ..... **[6]**

12 The diagram shows a sphere and a cone.



Not to scale

The sphere has radius 4 cm.
The cone has radius 15 cm and height 30 cm.

The sphere is completely filled with water.
The same amount of water is poured into the cone.

Work out the depth, d cm, of the water in the cone.
You must show your working.

[The volume V of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.

The volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

Sphere

$V = \frac{4}{3} \times \pi \times 4^3$ ✓

$= 268.08...$ ✓ cm^3

Large cone

$H = 30$

$H = d$

Small cone

$r = 15$

$r = \frac{d}{2}$ ✓

$V = \frac{1}{3} \times \pi \times \left(\frac{d}{2}\right)^2 \times d = 268.08$ ✓✓

$\frac{d^3}{4} = 256$

$d^3 = 1024$

$d = \sqrt[3]{1024} = 10.08$ cm ✓

$d =$ ..... **[6]**

13 y is directly proportional to $\sqrt{x}$.
$y = 1$ when $x = 16$.

Find a formula for y in terms of x.

$y = k \times \sqrt{x}$ ✓

$1 = k \times \sqrt{16}$

$\frac{1}{4} = k$ ✓

$y = \frac{1}{4}\sqrt{x}$ ✓

..... **[3]**

14 An estimate for the number of seals on an island is given by the formula

$P = 5200 \times 1.02^t$

where P is the number of seals t years after the start of year 2015.

(a) Write down the annual percentage increase in the number of seals on the island.

$1.02 = \frac{102}{100}$

(a) 2 % ✓ **[1]**

(b) Use the formula to show that there may have been about 4700 seals on the island at the start of year 2010. **[2]**

$5200 \div 1.02^5$ ✓

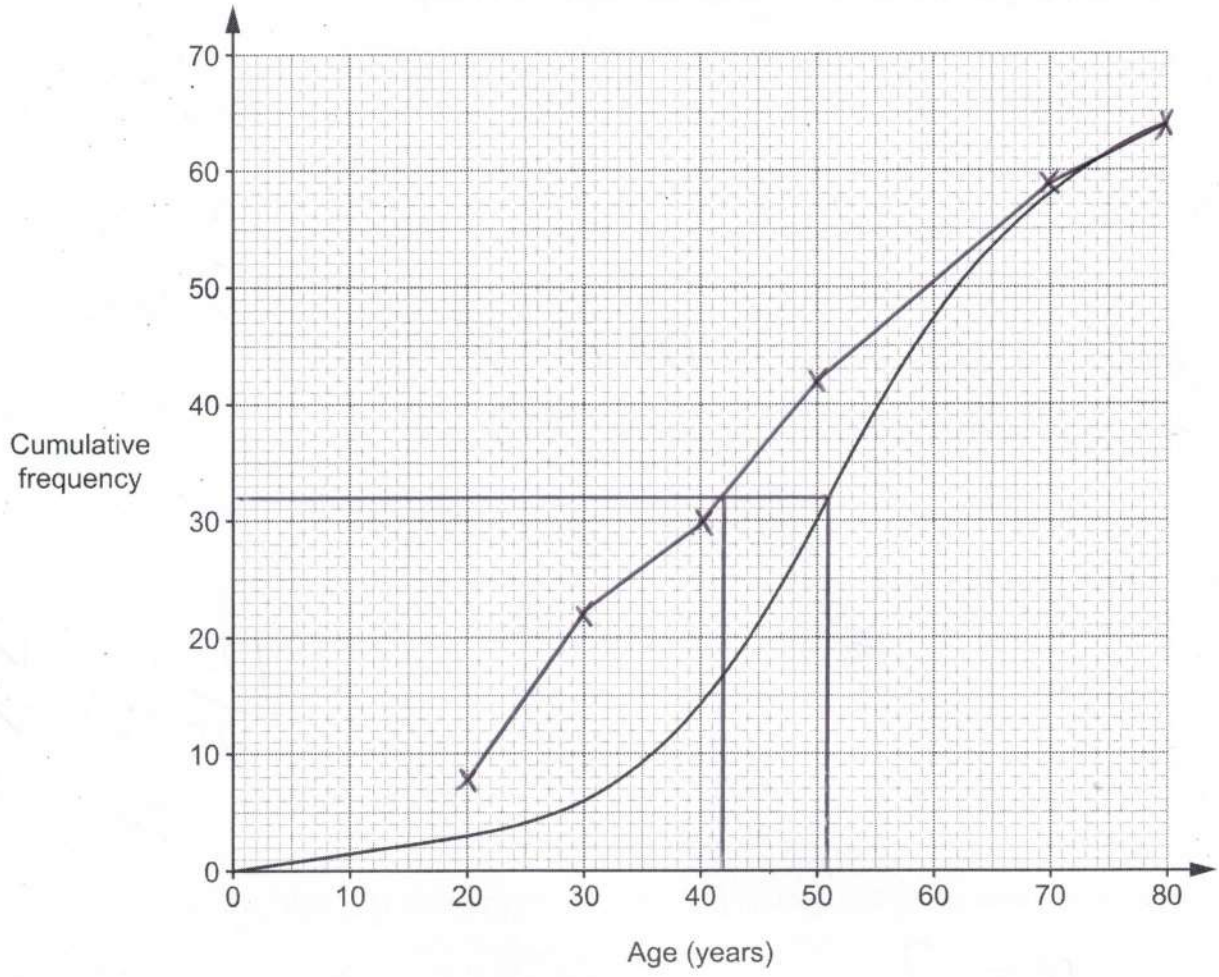
$= 4710$ ✓

OR

4700×1.02^5 ✓

$= 5189/5190$ ✓

15 The cumulative frequency graph shows the distribution of the ages of the members of a **tennis** club.



(a) The table summarises the ages of the members of a **cycling** club.

Age (*a* years)	$0 < a \leqslant 20$	$20 < a \leqslant 30$	$30 < a \leqslant 40$	$40 < a \leqslant 50$	$50 < a \leqslant 70$	$70 < a \leqslant 80$
Frequency	8	14	8	12	17	5

cf 8 22 30 42 59 64 ✓✓

On the graph above, draw the cumulative frequency graph of the ages of the members of the **cycling** club. **[5]**

curve OR polygon

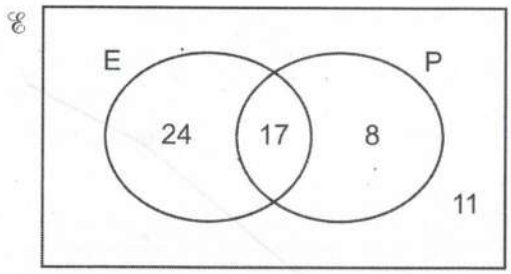
(b) Find out which club has younger members on average.
Give evidence to support your decision.

cycling ..... because ..... cycling median = 42
tennis median = 51
..... **[2]**

✓ ✓

16 A salesroom sells various types of car.
Some cars are electric (E), some are petrol (P), some are both and some are neither.

The Venn diagram below shows the salesroom's stock of cars.



A petrol car is picked at random. = out of 25

Find the probability that the car is also electric. = 17

17/25 ✓ ✓

..... **[2]**

17 Find the equation of the line through (4, 5) that is perpendicular to $y = 2x - 3$.

$m = 2$

$m_{\perp} = -\frac{1}{2}$ ✓

$y = mx + c$

$5 = -\frac{1}{2} \times 4 + c$

$c = 7$ ✓

$y = -\frac{1}{2}x + 7$ ✓

..... **[3]**

18 (a) The next term in a Fibonacci sequence is found by adding together the two previous terms.

(i) The first and second terms of a particular Fibonacci sequence are x and y.

Show that the fourth term of the sequence can be written as $x + 2y$. **[2]**

x, y, 3rd = x + y ✓

4th = x + y + y ✓

= x + 2y

(ii) The fourth term of the same Fibonacci sequence is 7.
The seventh term of the sequence is 31.

Work out the value of x and the value of y.
You must show your working.

5th = 2x + 3y

6th = 3x + 5y ✓

4th = x + 2y = 7 ✓ (×4)

7th = 5x + 8y = 31 ✓

5x + 8y = 31 −

4x + 8y = 28 ✓

x = 3

3 + 2y = 7

2y = 4

(a)(ii) $x =$ 3 ✓

$y =$ 2 ✓ **[6]**

(b) Here are the first four terms of a sequence.

1 $\sqrt{3}$ 3 $3\sqrt{3}$

Write an expression for the nth term.

$\sqrt{3}^0$ $\sqrt{3}^1$ $\sqrt{3}^2$ ....

$n = 1$ 2 3 ....

$\sqrt{3}^{(n-1)}$ ✓✓

(b) ..... **[2]**

(c) Here are the first four terms of a quadratic sequence.

−1 5 13 23

The nth term is $n^2 + bn + c$.

Find the value of b and the value of c.

6 8 10

2 2

✓

$S = -1$ 5 13 23

$n^2 = 1$ 4 9 16

$S - n^2 = -2$ 1 4 7

$3n = 3$ 6 9 12

$n^2 + 3n - 5$

(c) $b =$ 3 ✓

$c =$ −5 ✓ **[3]**

19 Describe the **single** transformation that maps the graph of $y = x^2$ onto the graph of $y = (x+3)^2 + 5$.

Translation $\begin{bmatrix} -3 \\ 5 \end{bmatrix}$ ✓ ✓ ✓

..... [3]

20 Mrs Sweet has 8 different milk chocolates and 9 different plain chocolates.

Her daughter chooses one of the milk chocolates.
Her son then chooses one of the plain chocolates.
Mrs Sweet then chooses one of the remaining chocolates.

Work out how many different combinations of three chocolates they can choose.

MC		PC		Any
8	x	9	x	15 left

✓✓

1080 ✓

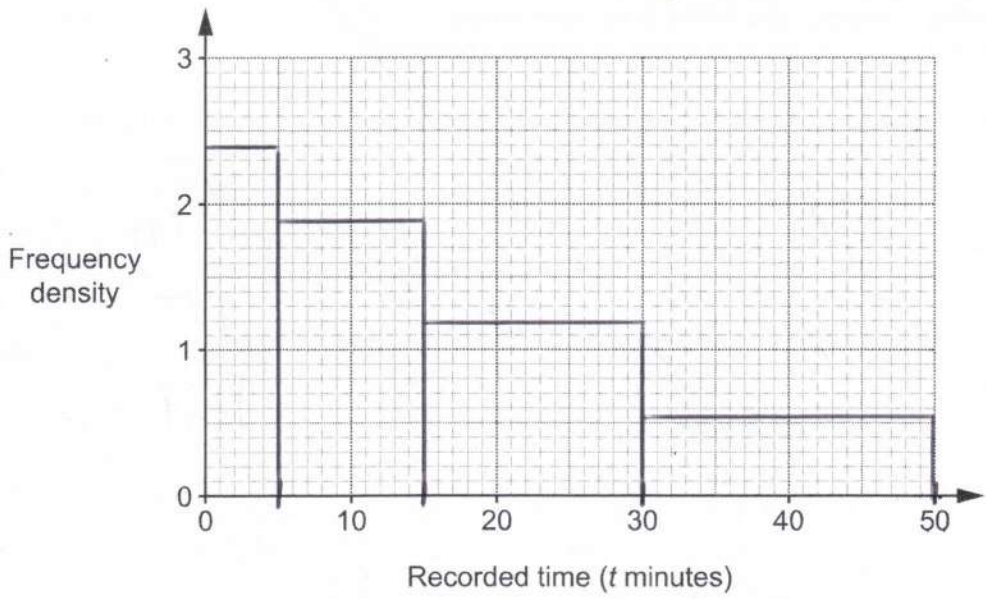
..... [3]

21 60 people each try to solve a puzzle.
The table summarises their recorded times.

Recorded time (t minutes)	Frequency
$0 < t \leqslant 5$	12
$5 < t \leqslant 15$	19
$15 < t \leqslant 30$	18
$30 < t \leqslant 50$	11

Area (Fd)
Width Height
5 2·4
10 1·9
15 1·2
20 0·55

(a) Draw a histogram to show this information.



[3]

(b) Those people who failed to solve the puzzle within 50 minutes were given a recorded time of 50 minutes.

Nina uses mid-interval values to estimate the mean recorded time of the 60 people.

Explain why Nina's answer is likely to be an under-estimate for the mean of the actual time taken by the 60 people.

mean would be higher as the 50min times would increase the total time.

[1]

Turn over for Question 22

22 Solve algebraically.

$x^2 + y^2 = 18$

$y = x - 6$

$x^2 + (x-6)^2 = 18$ ✓

$x^2 + x^2 - 12x + 36 = 18$ ✓

$2x^2 - 12x + 18 = 0$ ✓

$x^2 - 6x + 9 = 0$

$(x-3)(x-3) = 0$ ✓

$x = 3$

$y = 3 - 6 = -3$

$x =$ 3 ✓

$y =$ −3 **[5]**

END OF QUESTION PAPER