AQA Higher Practice Paper

NOT ORDERED BY DIFFICULTY

240 marks' worth of questions that **COULD** come up in papers 2 and 3. Do not revise these topics exclusively – this is not a predicted paper.

Materials
- For this paper you must have:
  - A calculator
  - Mathematical instruments

Instructions:
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer all questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information:
- The marks for questions are shown in brackets.

Advice:
- In all calculations, show clearly how you work out your answer.

Q1. *ABCD* is a cyclic quadrilateral. Not drawn accurately. Work out *x* and *y*.

_____

_____

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_____

$x =$ _____ degrees

$y =$ _____ degrees

(Total 4 marks)

Q2. *P* is the principal amount. *r* is the interest rate over a given period. *n* is the number of times that the interest is compounded. Circle the expression for the total accrued using compound interest.

$$P\left(1 + \frac{r}{100}\right)^n \qquad P + \left(\frac{r}{100}\right)^n$$

$$P\left(1 + \frac{n}{100}\right)^r \qquad P\left(1 + \frac{r^n}{100}\right)$$

(Total 1 mark)

Q3.   I increase a number by 24%
The answer is 6014.
What number did I start with?

_____

_____

_____

_____

_____

_____

Answer _____

(Total 3 marks)

Q4.   A small toy is made by joining a solid cone and a solid hemisphere together.
The cone and hemisphere each have radius 6 cm.

20 cm

6 cm
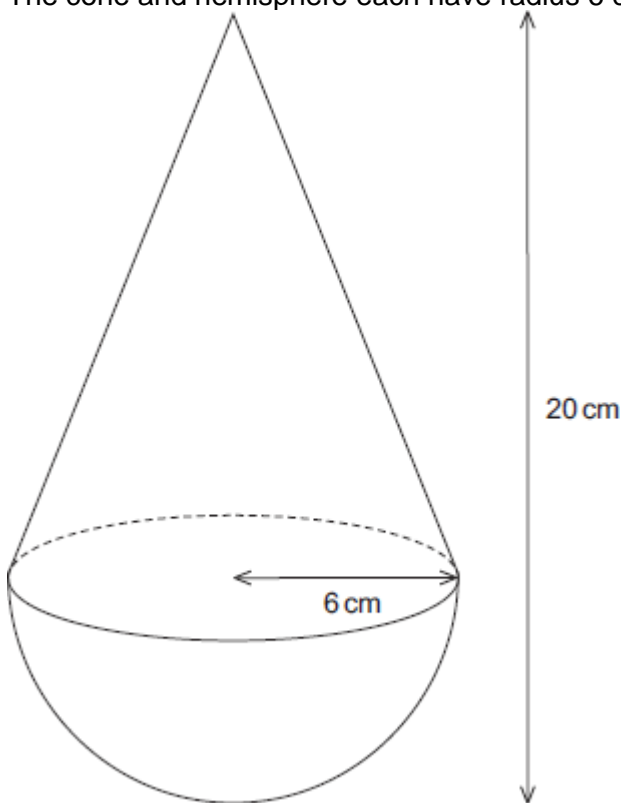
(a)   Show that the volume of the toy is 312π cm^3.

_____

_____

_____

_____

_____

_____

(4)

(b)   A larger version of the toy is made that has
          •   dimensions twice the size of the small toy
          •   mass 1.5 kilograms.
The toy is made from foam.
Work out the density of the foam.
Give your answer in grams per cubic centimetre.

_____

_____

_____

_____

_____

_____

_____

_____

                                    Answer _____ g per cm³
                                                                                (4)
                                                                    (Total 8 marks)

Q5.   An amount of money was invested for 8 years.
        It earned compound interest at 2.5% per year.
        After 8 years the total value of the investment was £11 696.67
        (a)   Tom is trying to work out the total interest earned.

        Tom

        Interest for 8 years = £11696.67 × 0.025 × 8

        State what is wrong with Tom's method.

_____

_____
                                                                                (1)
        (b)   Work out the total interest earned.

_____

_____

_____

_____

_____

_____
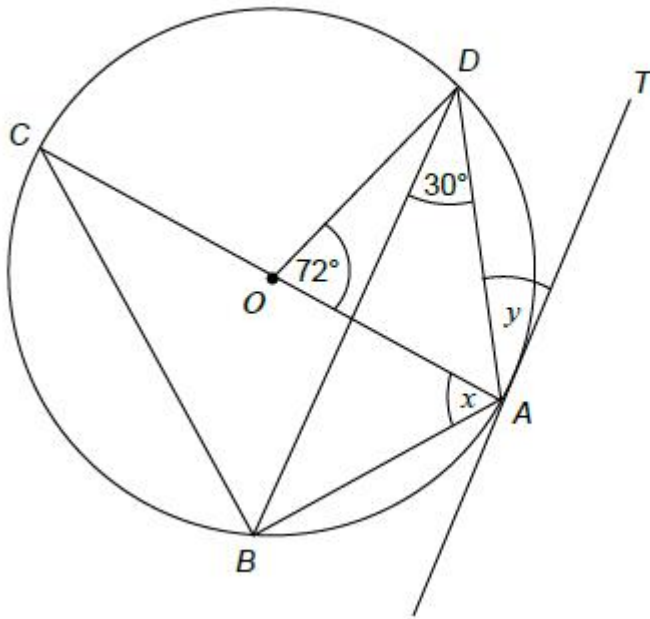
                                    Answer £ _____
                                                                                (3)
                                                                    (Total 4 marks)

Q6.   *A, B, C* and *D* are points on a circle, centre *O*.
        AC is a diameter of the circle.
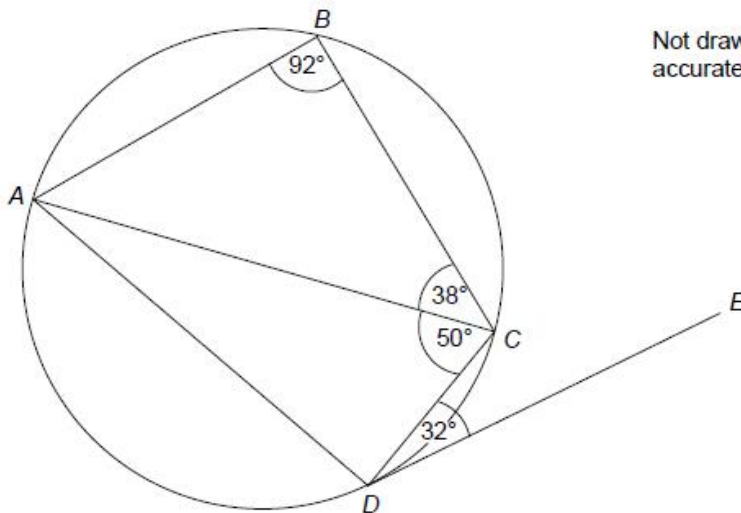   *AT* is a tangent to the circle.

Not drawn
accurately

Work out the size of angle *x* and the size of angle *y*.

_____

_____

_____

_____

_____

_____

_____

_____

                        x = ... degrees   *y* = ... degrees
                                                                        (Total 4 marks)

Q7.   A, B, C and D are points or
        Angle ABC = 92°
        Angle ACB = 38°
        Angle ACD = 50°
        Angle CDE = 32°

Not drawn
accurately

Tick whether each statement is true or false.
Give a reason for each answer.

Statement   True   False

AC is a diameter   ☐   ☐

Reason _____

_____

_____

Statement   True   False

Angle ADC = 88°   ☐   ☐

Reason _____

_____

_____

Statement   True   False

ABCD is a trapezium   ☐   ☐

Reason _____

_____

_____

Statement   True   False

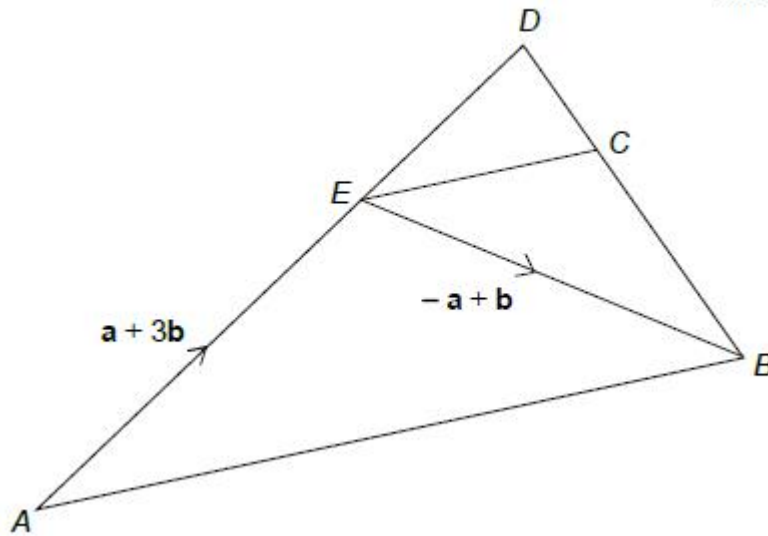DE is a tangent to the circle ☐   ☐

Reason _____

_____

_____

(Total 4 marks)

Q8.   *AED* is a straight line.

$\vec{AE} = a + 3b$

$\vec{EB} = -a + b$

Not drawn accurately

(a)   Work out the vector $\vec{AB}$

_____

_____
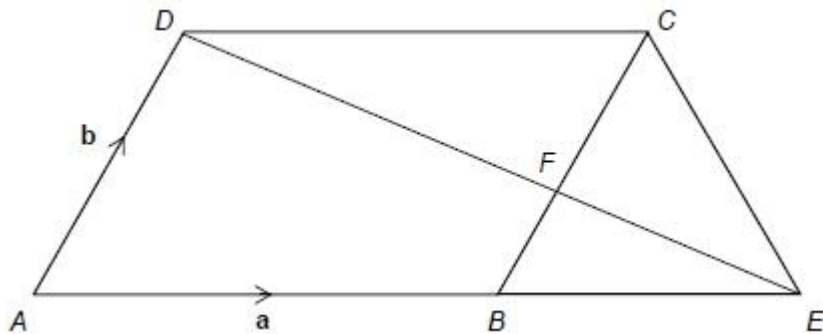
                              Answer _____
                                                                              (1)

(b)   Also $\vec{ED} = \frac{1}{3}\,\vec{AE}$ and $\vec{DC} = -\frac{1}{3}\,a$
Prove that *EC* is parallel to *AB*.

_____

_____

_____

_____
                                                                              (3)
                                                                    (Total 4 marks)

Q9.   *ABCD* is a parallelogram.
       ABE is a straight line and *AB* : *BE* = 3 : 2
       BC and ED intersect at F.
       $\vec{AB}$ = a   and $\vec{AD}$ = b
       Not drawn accurately

(a)   Work out $\vec{ED}$ in terms of a and b.
Give your answer in its simplest form.

_____

_____

_____

_____

                           Answer _____
                                                                              (3)

(b)   Deduce $\vec{EF}$ in terms of a and b.

_____

_____

_____

_____

                           Answer _____
                                                                              (2)
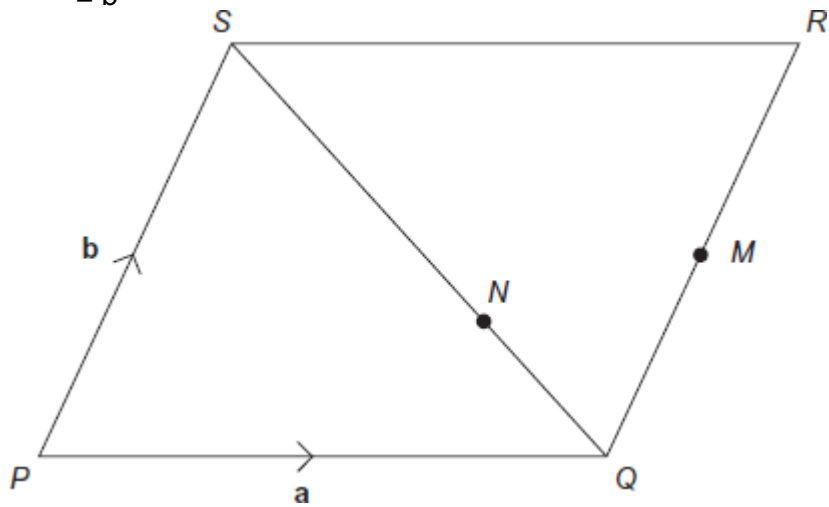   (Total 5 marks)
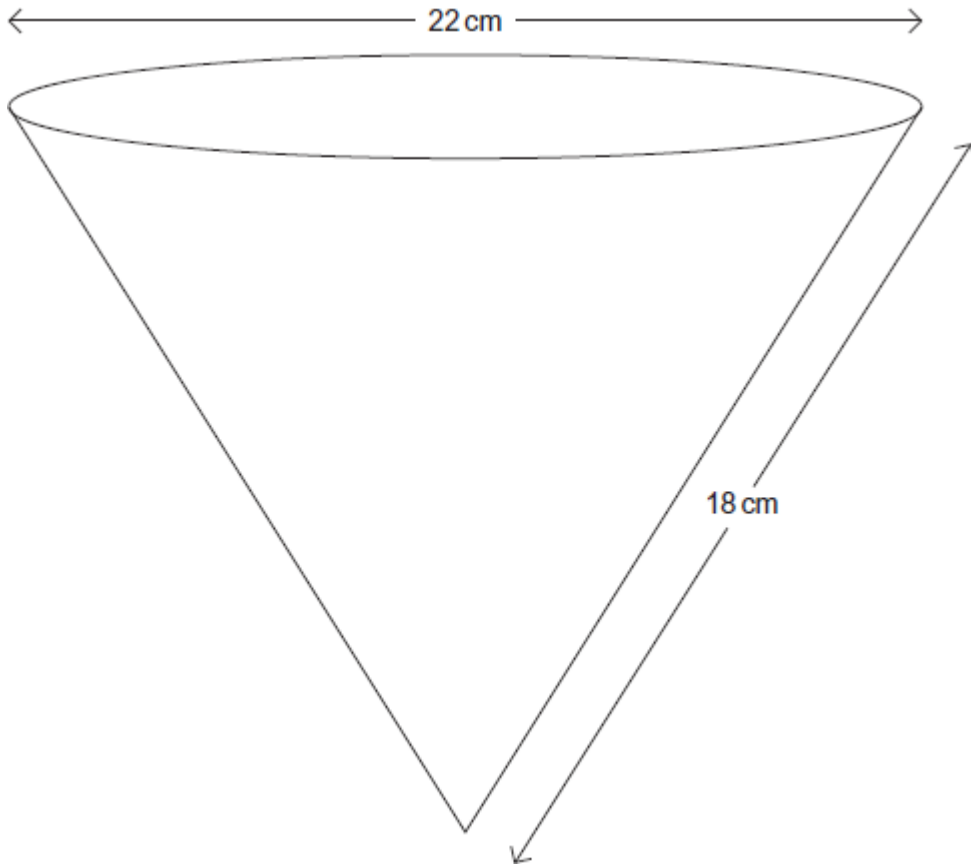
Q10. *PQRS* is a parallelogram.
M is the midpoint of *QR*.
$QN : NS = 1 : 2$

$\overrightarrow{PQ}$ = a

$\overrightarrow{PS}$ = b

(a)   Write the vector $\overrightarrow{PM}$ in terms of a and b.

_____

Answer _____

(1)

(b)   Prove that *PNM* is a straight line.

_____

_____

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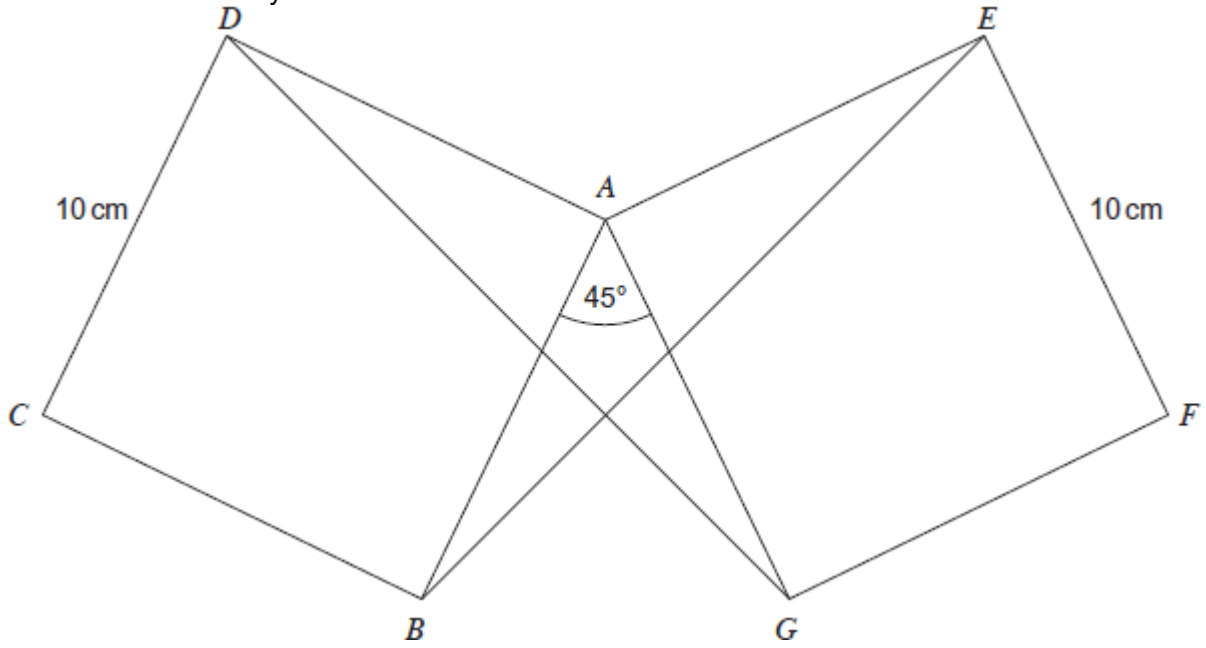_____

(4)
(Total 5 marks)

Q11. A paper filter is in the shape of a hollow cone of diameter 22 cm
      The slant height of the cone is 18 cm

← 22 cm →

18 cm

Work out the area of paper used to make the filter.
Give your answer to 2 significant figures.

_____

_____

_____

_____

_____

_____

Answer _____ cm^2

(Total 3 marks)

Q12. Here are two similar solids, *A* and *B*.

8 cm

B

5 cm

A

The volume of *B* is 400 cm³
Is the volume of *A* approximately one quarter of the volume of B?
You must show your working.

_____

_____

_____

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_____

Answer _____

(Total 4 marks)

Q13. *ABCD* and *AEFG* are identical squares.
CD = *EF* = 10 cm
Angle *BAG* = 45°
Not drawn accurately

Prove that triangles *AGD* and *ABE* are congruent.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

Q14. The diagram shows two pieces of glass.
Not drawn accurately

←——— 50 cm ———→   ←——— 75 cm ———→

The pieces are similar.
The area of the small piece is 6000 cm^2
Glass costs £80 per square metre.
Work out the cost of the large piece.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer £ _____

(Total 5 marks)

Q15. The area of shape A is 36 cm^2
Shape B is similar to shape A with sides 4 times bigger.
Circle the calculation to work out the area of shape B.

$36 + 4$ $36 \div 4$ 36×4 36×4^2

(Total 1 mark)

Q16. On Friday, Greg takes part in a long jump competition.
He has to jump at least 7.5 metres to qualify for the final on Saturday.
- He has up to three jumps to qualify.
- If he jumps at least 7.5 metres he does not jump again on Friday.

Each time Greg jumps, the probability he jumps at least 7.5 metres is 0.8
Assume each jump is independent.

(a) Complete the tree diagram.

First jump   **Second jump**   **Third jump**

0.8 ⟨ Qualify

____ Does not qualify

(2)

(b) Work out the probability that he does not need the third jump to qualify.

_____

_____

_____

_____

Answer _____

(2)

(Total 4 marks)

Q17. A bag contains 12 discs.
7 are red. 3 are blue. 2 are yellow.
Two discs are taken from the bag at random, without replacement.
Work out the probability that the two discs are the same colour.

_____

_____

_____

_____

_____

_____

_____

Answer _____

(Total 4 marks)

Q18. Two bags, A and B, contain numbered counters.
A counter is chosen at random from each bag.
Here are the 8 counters in bag A.

(1)   (2)   (2)   (3)

(4)   (4)   (4)   (5)

The table gives the probabilities of the numbers on the counters in bag B.

Number on counter	6	7	8	9
Probability	0.2	0.1	0.4	0.3

Which bag has the greater probability of choosing an even number?
You must show your working.

_____

_____

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_____

Answer _____

(Total 2 marks)

Q19. The probability that Gina goes to the gym on Saturday is 0.9
The probability that Dave goes to the gym on Saturday is 0.6
These probabilities are independent.
(a)   Calculate the probability that both Gina and Dave go to the gym on Saturday.
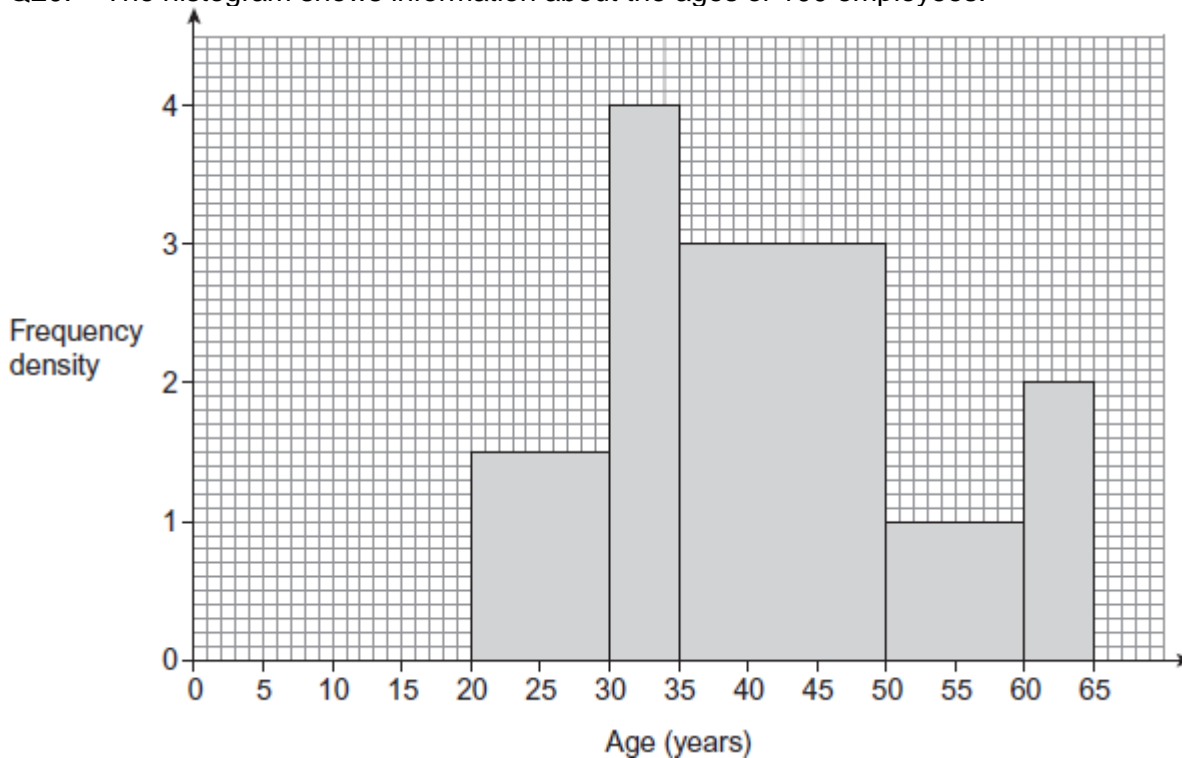
_____

_____

Answer _____

(1)

(b)   If Gina goes to the gym on Saturday the probability that she goes on Sunday is 0.2
If Gina does not go to the gym on Saturday the probability that she goes on Sunday is 0.7
Calculate the probability that Gina goes to the gym on exactly one of the two days.

_____

_____

_____

_____

_____

Answer _____

(4)
(Total 5 marks)

Q20. The histogram shows information about the ages of 100 employees.

Age (years)

Work out an estimate of the median age of the employees.

_____

_____

_____

_____

_____

_____

Answer _____years

(Total 4 marks)

Q21. (a)   Garage A sold 4960 vehicles.
The garage takes a sample of customers, stratified by type of vehicle sold.
Some information about the sample is shown.

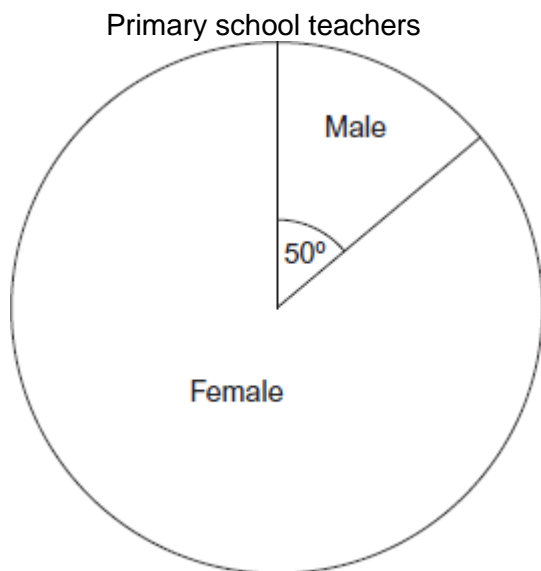|	Car	People carrier	Van	Total
Number sold	2520			4960
Number in sample	126	44		

Complete the table.

(3)

(b)   Garage B sold 3790 vehicles, to 3 significant figures.
Write down the minimum and maximum possible number sold by Garage B.

Minimum _____

Maximum _____

(2)

(Total 5 marks)

Q22.   The pie chart shows the proportion of male and female teachers in 15 074 schools.

Primary school teachers

The mean number of teachers per school is 13.7
Work out the total number of female teachers in these schools.
Give your answer to 2 significant figures.

_____

_____

_____

_____

_____

_____

_____

Answer _____

(Total 5 marks)

Q23.   Circle the quadratic sequence.

2   8   14   22   1   8   27   64

2   4   8   16   1   4   9   16

(Total 1 mark)

Q24. Joe asked 230 students how long it took them to travel to school.
The results are shown in the table.

Travelling time, t (minutes)	Number of students
0 < t ≤ 5	44
5 < t ≤ 10	50
10 < t ≤ 20	54
20 < t ≤ 30	37
30 < t ≤ 60	45

This is Joe's attempt to draw a histogram to show the data.

Travelling time
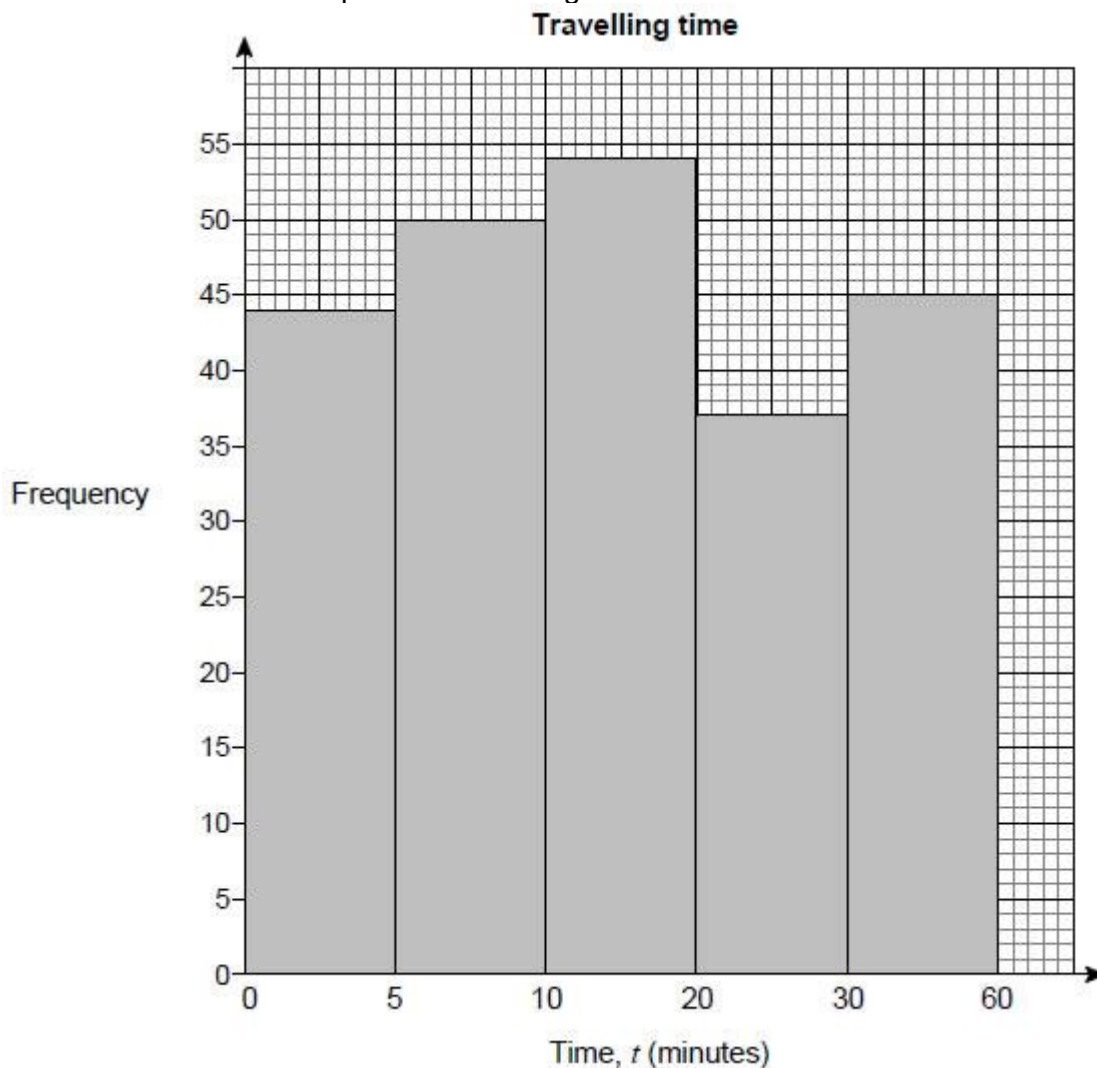
Make two criticisms of his histogram.

Criticism 1 _____

_____

Criticism 2 _____

_____

(Total 2 marks)

Q25. Here is some information about the number of books read by a group of people in 2014
One of the frequencies is missing.

Number of books	Frequency	Midpoint	
0 – 4	16	2	
5 – 9		7	
10 – 14	20	12	
15 – 19	10	17	

Midpoints are used to work out an estimate for the mean number of books read.
The answer is 8.5
Work out the missing frequency.

_____

_____

_____

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_____

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_____

Answer _____
(Total 5 marks)

Q26. The histogram shows the ages, in years, of members of a chess club.
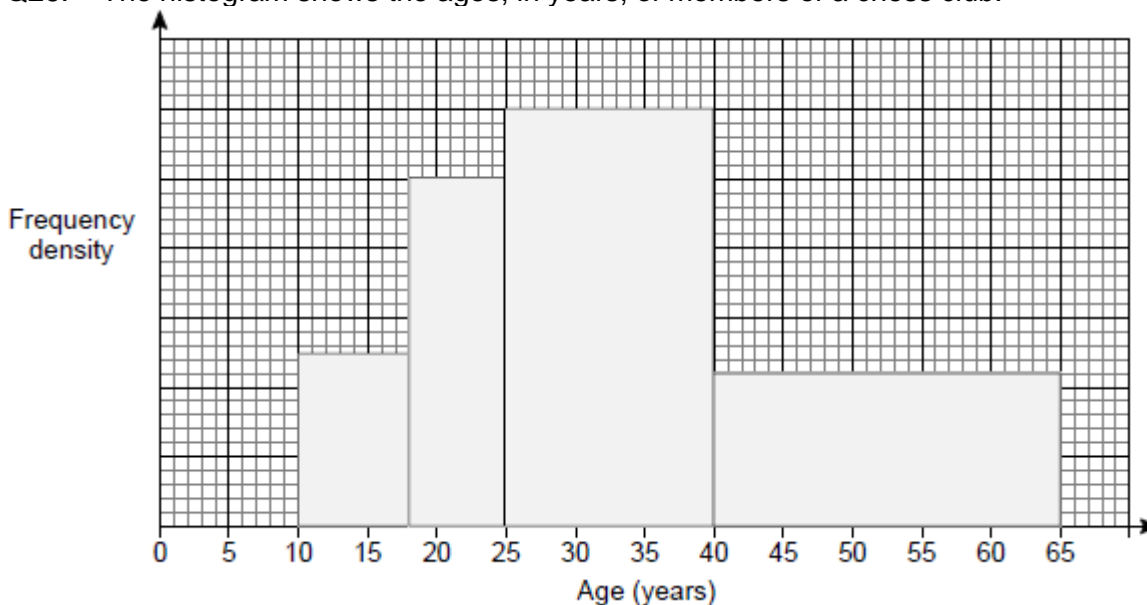
There are 22 members with ages in the range 40 ≤ age < 65
Work out the number of members with ages in the range 25 ≤ age < 40

_____

_____

_____

_____

Answer _____
(Total 4 marks)

Q27. The histogram shows information about the times some students revised for a test.
The first bar represents students who revised for less than 10 minutes.
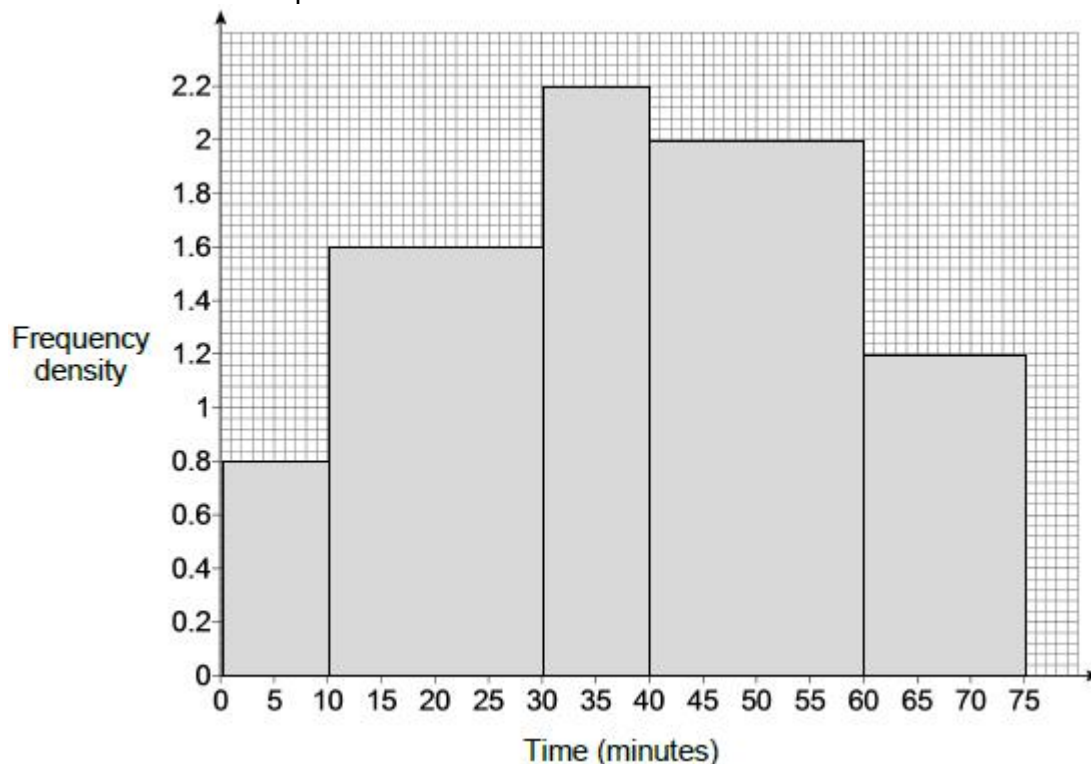
Estimate the number of students who revised for less than 45 minutes.

_____

_____

_____

_____

_____

Answer _____

(Total 3 marks)

Q28. (a) The nth term of a sequence is $n^2 + 12n + 27$
By factorising, or otherwise, show that the 20th term can be written as the product of two prime numbers.

_____

_____

_____
(2)

(b) The nth term of a different sequence is $n^2 - 6n + 14$
By completing the square, or otherwise, show that every term is positive.

_____

_____

_____
(3)
(Total 5 marks)

Q29. Points in the shaded region satisfy three inequalities.
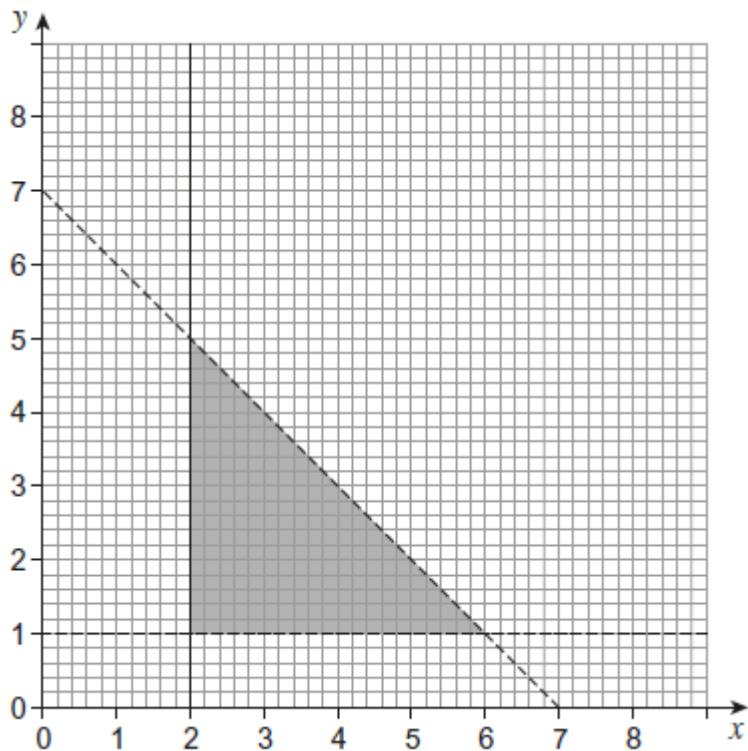
Use inequalities to describe the shaded region.

_____

_____

_____

_____

_____

(Total 3 marks)

Q30. (a) Write $x^2 + 6x + 10$ in the form $(x + a)^2 + b$

_____

_____

_____

Answer _____

(2)

(b) Hence, write down the coordinates of the turning point of the curve $y = x^2 + 6x + 10$

Answer (.......................... , ...)

(1)

(Total 3 marks)

Q31. (a) Write $x^2 - 10x + 29$ in the form $(x - a)^2 + b$

_____

_____

_____

Answer _____

(2)

(b) A sketch of $y = x^2 + cx + d$ is shown.
The turning point is (3, 5)

Not drawn accurately
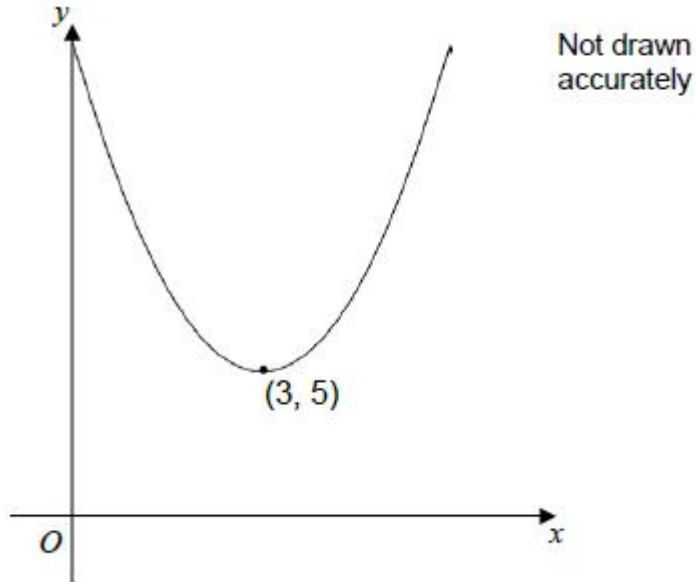
Work out the values of c and d.

_____

_____

_____

_____

_____

c = ... d = ...

(3)

(Total 5 marks)

Q32. Work out an expression for the nth term of the quadratic sequence

       11   15   21   29   39   __

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

                                    nth term = _____

(Total 4 marks)

Q33. (a)   Line M has the equation $3x + 2y = 7$
Circle the gradient of line M.

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

(1)

(b)   Line N has the equation $y = 5 - \dfrac{3}{4}x$
Circle the gradient of a line that is perpendicular to line N.

$-\dfrac{4}{3}$ $\dfrac{3}{4}$ $\dfrac{4}{3}$ 3

(1)
(Total 2 marks)

Q34. The gradient of line *OR* is $\frac{7}{4}$
PQ is perpendicular to *OR*.
P is the point (14, 0).
Not drawn accurately
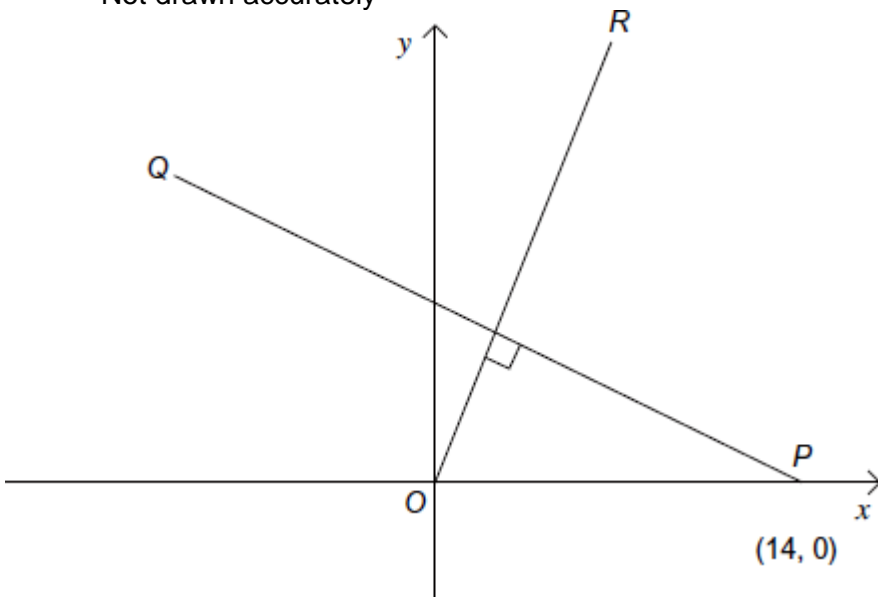
Work out the equation of line *PQ*.
Give your answer in the form *ax* + *by* = *c*, where *a*, *b* and *c* are integers.

_____

_____

_____

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_____

Answer _____

(Total 4 marks)

Q35. (a) Solve $\frac{2w-3}{6} = 4$

_____

_____

_____

_____

_____

w = _____

(3)

(b) Solve $4x^2 - 25 < 0$

_____

_____

_____

_____

_____

_____

Answer _____

(3)

(c) Solve $\dfrac{1}{y-6} = 5$

_____

_____

_____

_____

_____

_____

$y = $ _____

(3)

(Total 9 marks)

Q36. A circle has equation $x^2 + y^2 = \dfrac{1}{4}$

Circle the length of its radius.

$\dfrac{1}{16}$ $\qquad$ $\dfrac{1}{8}$ $\qquad$ $\dfrac{1}{4}$ $\qquad$ $\dfrac{1}{2}$

(Total 1 mark)

Q37. Points in the shaded region satisfy three inequalities.
One of the inequalities is $y \leq 2x + 5$

(a) Circle the inequality with boundary line *A*.

$x + y \geq 7$ $\qquad$ $x + y < 7$ $\qquad$ $x + y \leq 7$ $\qquad$ $x + y > 7$

(1)

(b) Circle the inequality with boundary line *B*.

$2y \geq x + 4$ $\qquad$ $2y \leq x + 4$ $\qquad$ $y \geq x + 2$ $\qquad$ $y \leq x + 2$

(1)
(Total 2 marks)

Q38. Solve
$$5x - y = 5$$
$$2y - x^2 = 11$$
You must show your working. Do not use trial and improvement.

_____

_____

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Answer _____

(Total 6 marks)

Q39. The Venn diagram shows information about a coin collection.
ξ = 120 coins in the collection
T = coins from the 20th century
B = British coins
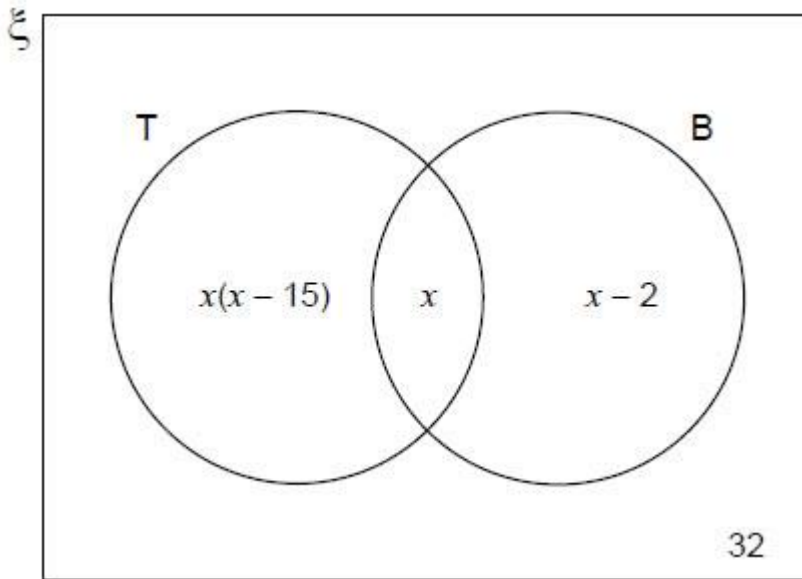
A coin is chosen at random.
It is British.
Work out the probability that it is from the 20th century.

_____

_____

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_____

_____

_____

_____

_____

Answer _____

(Total 5 marks)

Q40. For all values of x, $\quad f(x) = x^2 + 1 \quad g(x) = x - 5$

(a) Show that $\quad fg(x) = x^2 - 10x + 26$

_____

_____

_____

_____

_____

_____

_____

(2)

(b) Solve $\quad fg(x) = gf(x)$

_____

_____

_____

_____

_____

_____

_____

_____

$x = $ _____

(4)

(Total 6 marks)

Q41. A circle has equation $\quad x^2 + y^2 = 4$

Circle the length of its radius.

$\qquad$ 2 $\qquad\qquad$ 4 $\qquad\qquad$ 8 $\qquad\qquad$ 16

(Total 1 mark)

Q42. The speed-time graph for a car's journey is shown.
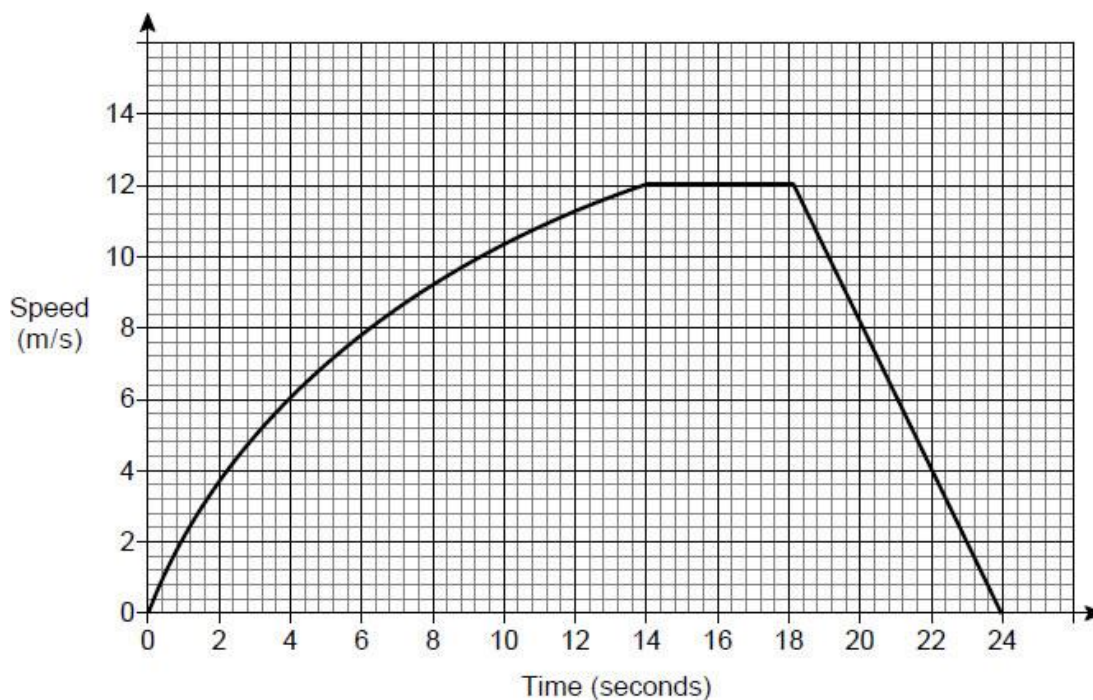
(a) Estimate the acceleration at 6 seconds.
You must show your working.

_____

_____

_____

_____

Answer _____ m/s^2

(3)

(b) Estimate the average speed of the car for the journey.
You must show your working.

_____

_____

_____

_____

Answer _____ m/s

(4)

(c) Evaluate your answer to part (b). Tick a box.

☐ underestimate ☐ exact ☐ overestimate

Comment _____

_____

(1)
(Total 8 marks)

Q43. (a) Here is a circle, centre O.

Not drawn accurately
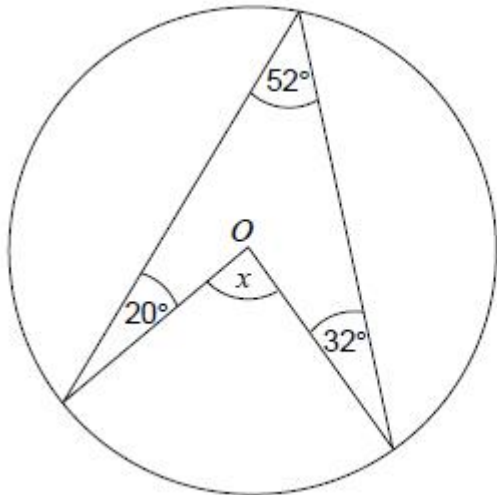
Work out the size of angle x.
Circle your answer.

26°   72°   84°   90°   104°

(1)

(b)   M, N and S are points on circle C_1
RST is a tangent to C_1
Circle C_2 passes through the centre O, S and M of circle C_1

Not drawn accurately
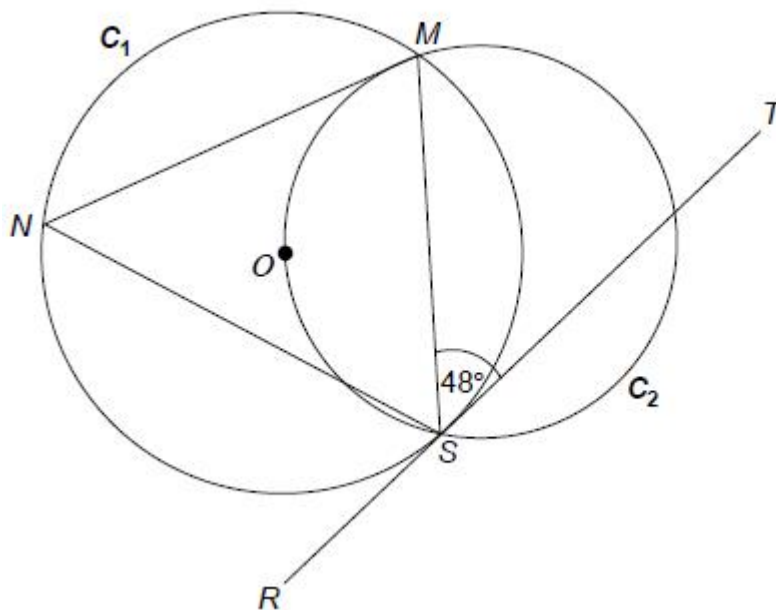
Prove that SM is not a diameter of circle C_2
Give reasons for your answer.

_____

_____

_____

_____

_____

_____

(3)
(Total 4 marks)

Q44. Expand and simplify $(2x + 5)(2x - 5)(3x + 7)$

_____

_____

_____

_____

_____

_____

Answer _____

(Total 3 mark)

Q45. Prove that $5n - (2n + 3)(n + 1)$ is always negative.

_____

_____

_____

_____

_____

(Total 3 marks)

Q46. Prove that $3(x + 1)(x + 7) - (2x + 5)^2$ is never positive.

_____

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_____

(Total 5 marks)

Q47. *w*, *x* and *y* are three integers.

w is 2 less than *x*

y is 2 more than *x*

Prove that $wy + 4 = x^2$

_____

_____

_____

_____

_____

_____

_____

(Total 3 marks)

Q48. Show that $\frac{2w+4}{w^2-25} \times \frac{w+5}{w^2+3w+2} \times (3w^2 - 16 + 5)$ simplifies to $\frac{aw + b}{cw + d}$ where *a*, *b*, *c* and *d* are integers.

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_____

(Total 5 marks)

Q49. An empty container has a capacity of 80 000 litres to 1 significant figure.
Mel pours in 7400 litres of water to 2 significant figures.
She says,
"I have filled more than 10% of the container."
Is she correct?
You must show your working.

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____

(Total 4 marks)

Q50. (a)   Show clearly that $(2x - 3y)(2x + 3y) \equiv 4x^2 - 9y^2$

_____

_____

_____

(1)

(b)   Show clearly that $\dfrac{3}{\sqrt{2}} \equiv \dfrac{3\sqrt{2}}{2}$

_____

_____

(1)

(c)   Work out the value of $\left(2\sqrt{3} - \dfrac{3}{\sqrt{2}}\right)\left(2\sqrt{3} + \dfrac{3}{\sqrt{2}}\right)$

_____

_____

_____

_____

_____

Answer _____

(3)

(Total 5 marks)

Q51. *AB*, *CD* and *YZ* are straight lines.
All angles are in degrees.
Not drawn accurately

Show that *AB* is parallel to *CD*.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

Q52. In this question use
1 pound = 0.4536 kilograms
1 inch = 2.54 centimetres.
The pressure of a basketball is 7.5 pounds per square inch.
Work out this pressure in grams per square centimetre.

_____

_____

_____

_____

_____

_____

_____

Answer _____ g/cm²
(Total 4 marks)

Q53. Circle the expression that is equivalent to $\dfrac{2x^2+1}{x}$ where x is not equal to 0

$2x + 1$ $\qquad$ $2x^2 + \dfrac{1}{2}$ $\qquad$ $2x + \dfrac{1}{2}$ $\qquad$ $4x + \dfrac{1}{2}$

(Total 1 mark)

Q54. A calculator gives a value of π as 3.14159

An approximation for π is $\sqrt{\dfrac{40}{3} - \sqrt{12}}$

Show that the value of the approximation is within 0.01% of the calculator value.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

Q55.   Here is a sketch of a speed-time graph for part of a journey.

The average speed from 0 to t seconds was 7.2 m/s.
Work out the value of t.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____ seconds
(Total 5 marks)

Q56. Two triangular lawns are shown.
Wire fencing is needed for all five sides.

Not drawn accurately

40°

100 m

30°

120 m
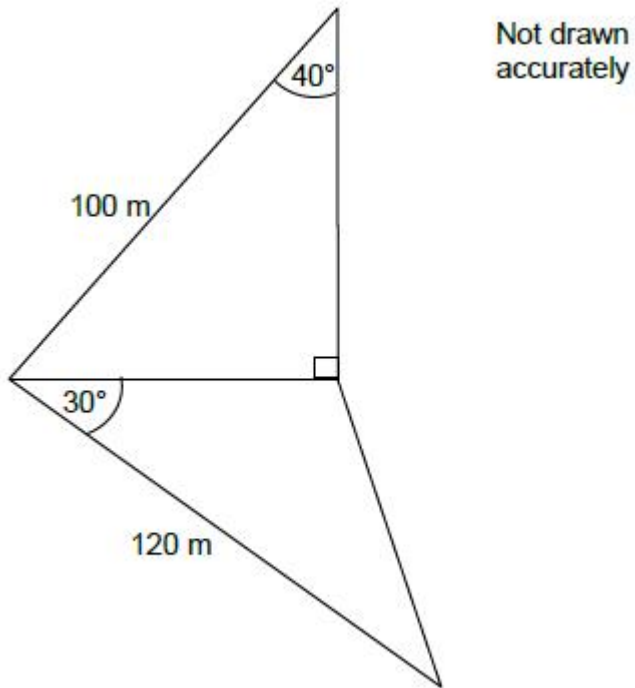
Wire fencing is sold in 50-metre rolls.
Work out the number of rolls needed.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____

(Total 6 marks)

Q57. A formula connecting speed (s), distance (d) and time (t) is

$$s = \frac{d}{t}$$

$d = 160$ to 2 significant figures
$t = 7.2$ to 2 significant figures
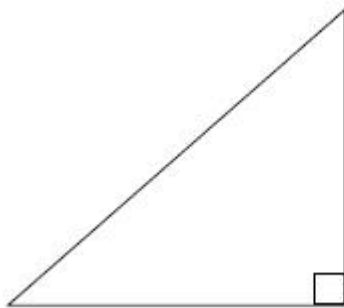Work out the upper and lower bounds for s.
Give your answers to 3 significant figures.

_____

_____

_____

_____

_____

_____

_____

_____

Upper bound _____

Lower bound _____

(Total 4 marks)

Q58. The area of a right-angled, isosceles triangle is 4 cm^2

Not drawn
accurately

Work out the perimeter of the triangle in centimetres.
Give your answer in the form $a + b\sqrt{c}$, where a, b and c are integers.

_____

_____

_____

_____

_____

_____

Answer _____ cm

(Total 4 marks)

Q59. A menu has a choice of 3 starters, 5 main courses and 4 desserts.
How many different choices of a 3-course meal are possible?
Circle your answer.

12   23   60   972

(Total 1 mark)

Q60. Work out $\sqrt[3]{8} \times 5^{-2}$
Give your answer as a decimal.

_____

_____

_____

_____

_____

Answer _____

(Total 3 mark)

Q61. A sequence of numbers is formed by the iterative process $a_{n+1} = (a_n)^2 - a_n$
(a)   Describe the sequence of numbers when $a_1 = 1$
Show working to justify your answer.

_____

_____

(1)

(b)   Describe the sequence of numbers when $a_1 = -1$
Show working to justify your answer.

_____

_____

_____

(2)

(c)   Work out the value of a_2 when $a_1 = 1 - \sqrt{2}$

_____

_____

_____

_____

Answer _____

(2)

(Total 5 marks)