Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2019

Mathematics

Unit T4
(With calculator)
Higher Tier

[GMT41] *GMT41*

TUESDAY 8 JANUARY, 9.15am–11.15am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all seventeen** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in Question **4**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

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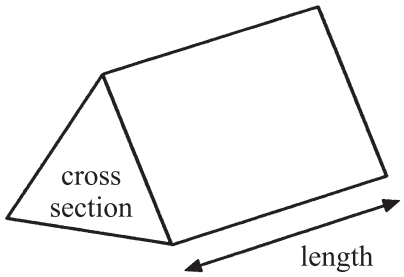
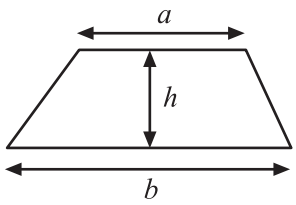
Formula Sheet

Volume of prism = area of cross section × length

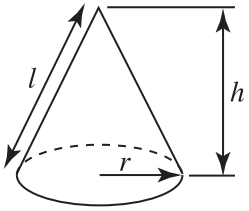


Area of trapezium $= \frac{1}{2}(a+b)h$



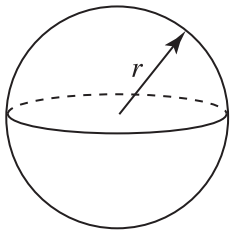
Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$

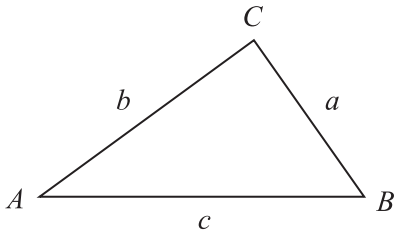


Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



In any triangle *ABC*



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sine Rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle $= \frac{1}{2}ab\sin C$

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(Questions start overleaf)

1 Peter, Jack and Colin share a flat. They pay the rent monthly.

Peter pays 30% of the monthly rent.

Jack pays $\frac{3}{8}$ of the monthly rent.

Colin pays £520 of the monthly rent.

Calculate the total monthly rent for the flat.

Answer £ _____ [5]

2 Solve $\frac{x+3}{2} = \frac{5x}{6}$

Answer x = _____ [4]

3 Factorise

(a) $10cp^2 - 4cp$

Answer _____ [2]

(b) $y^2 - 1$

Answer _____ [1]

(c) $k^2 - 2k - 3$

Answer _____ [2]

Quality of written communication will be assessed in this question.

4 PQR is a right-angled triangle.

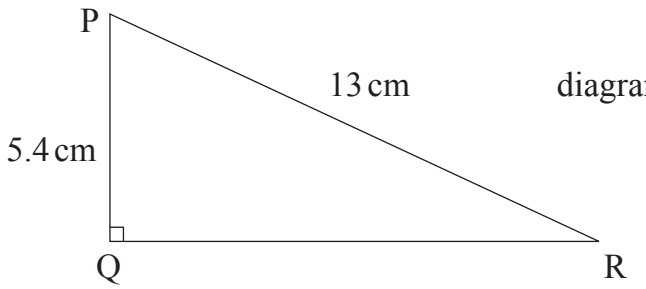

diagram not drawn accurately

By how many degrees is angle P bigger than angle R?

Give your answer to the nearest degree.

Show all your working clearly.

Answer _____ ° [5]

5 Adam needs to know the weight of his filled suitcase.

He weighs himself on the scales. The reading is 76 kg to the nearest kg.

He then weighs himself holding the filled suitcase.

The reading is 104 kg to the nearest kg.

Find the minimum possible weight of the filled suitcase.

Answer _____ kg [3]

[Turn over

6 **(a)** The area of the sector shown is $22.62\,cm^2$

Calculate the size of angle A.

Give your answer to the nearest degree.

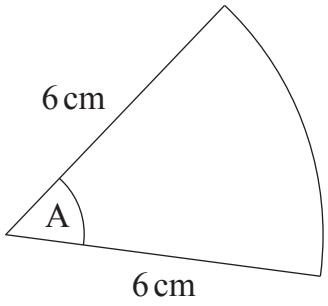

diagram not drawn accurately

Answer _____ ° [3]

(b) Hence find the perimeter of the sector shown.

Answer _____ cm [2]

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(Questions continue overleaf)

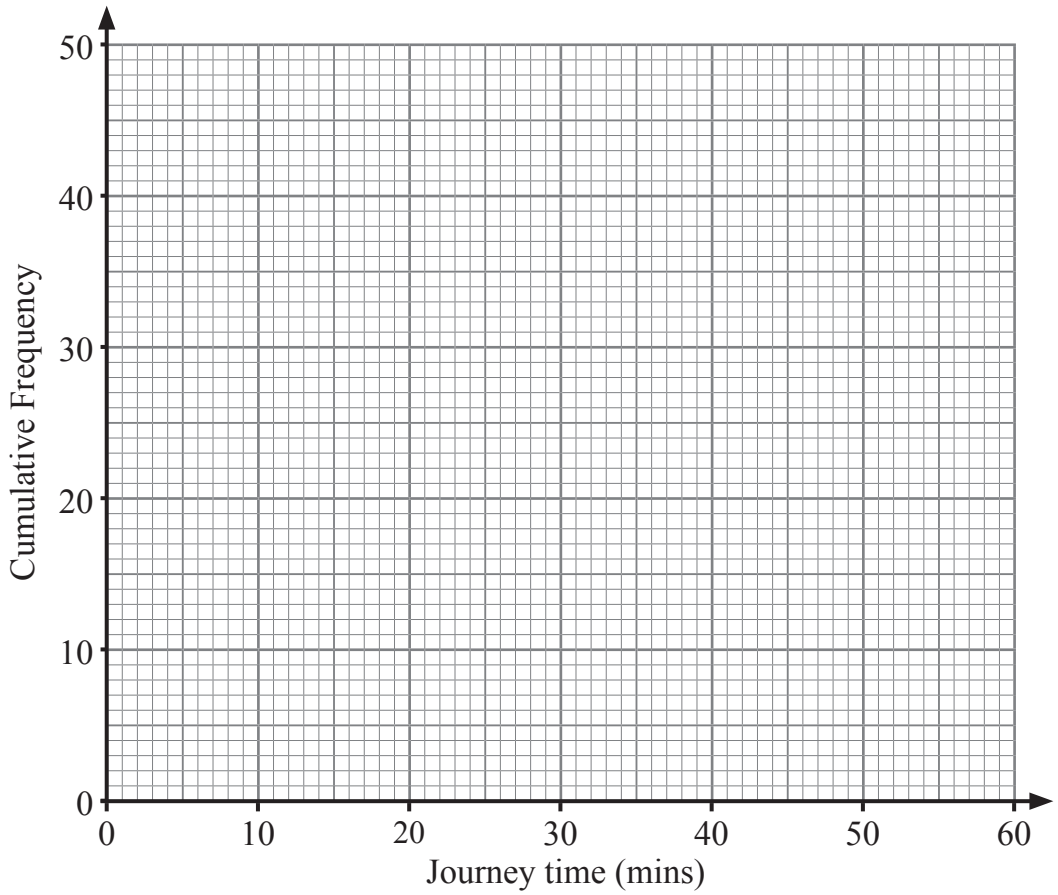
7 The cumulative frequency table gives data about the length of time it takes for 50 workers to travel to work one morning.

Journey time (t minutes)	Cumulative Frequency
$t \leqslant 20$	7
$t \leqslant 25$	22
$t \leqslant 30$	36
$t \leqslant 35$	45
$t \leqslant 45$	49
$t \leqslant 60$	50

(a) How many workers had a journey time between $\frac{1}{2}$ and $\frac{3}{4}$ hour?

Answer _____ [1]

(b) On the graph paper below, draw a cumulative frequency graph to illustrate the data.



[3]

(c) Use the graph to estimate the percentage of workers whose journey time was longer than 40 minutes.

Answer _____% [2]

(d) Use the graph to estimate the inter-quartile range of the journey times.

Answer _____ mins [2]

[Turn over

8 Solve $x^2 - 7x - 9 = 0$

Give your answers correct to 2 decimal places.

Answer _____ [3]

9 The variable V varies **inversely** as the **square** of another variable P.

When V = 2.25, P = 84

(a) Find the formula for V in terms of P.

Answer _____ [3]

(b) Calculate the value of V when P = 63

Answer _____ [2]

(c) Calculate the value of P when V = 1.44

Answer _____ [2]

(d) When P is doubled what happens to the value of V?

Answer _____ [2]

[Turn over

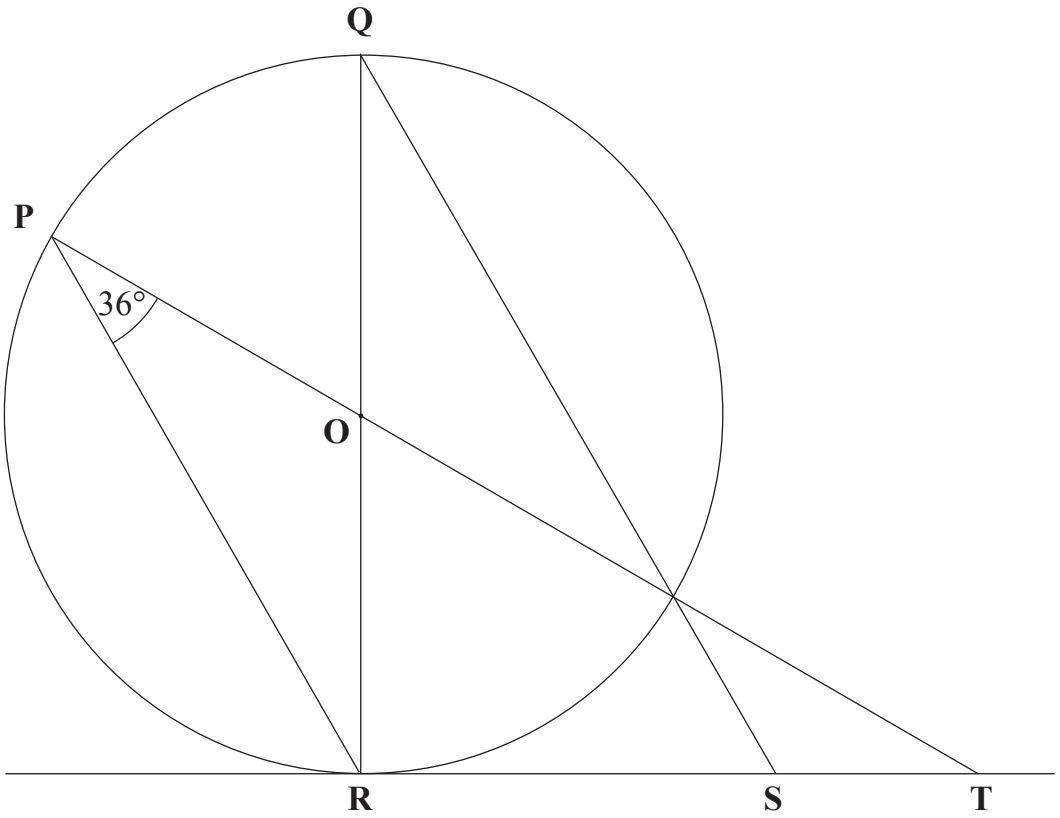
10 Find the equation of the line which goes through $(0, -4)$ and is perpendicular to the line $2x + 3y = 9$

Answer _____ [3]

11 In the diagram shown, O is the centre of the circle.

P, Q and R are points on the circumference of the circle.

RST is a tangent to the circle.



Calculate the size of

(a) angle ROT,

Answer _____° [1]

(b) angle OTR,

Answer _____° [1]

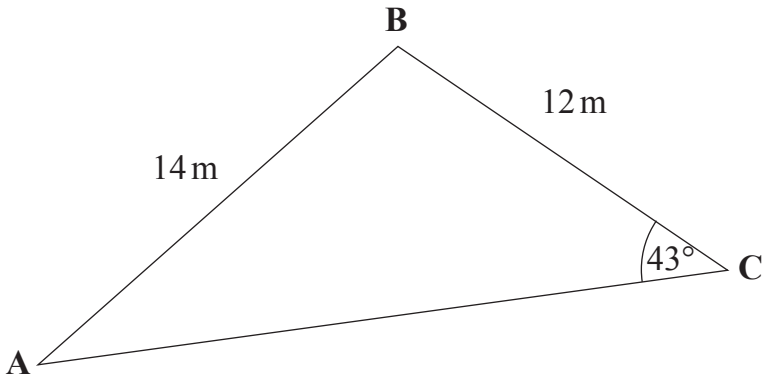
(c) angle QSR.

Answer _____° [1]

[Turn over

12 ABC is a triangle with sides of length 12 m and 14 m and angle 43° as shown.

Find the area of the triangle.



Answer _____ m^2 [4]

13 **(a)** Find the value of m given that

$$16 = 0.5^{-\frac{m}{4}}$$

Answer $m =$ _____ [2]

(b) Simplify fully

$$\frac{3x^2 - 6xy}{4x^2 - 8xy - 3xy + 6y^2}$$

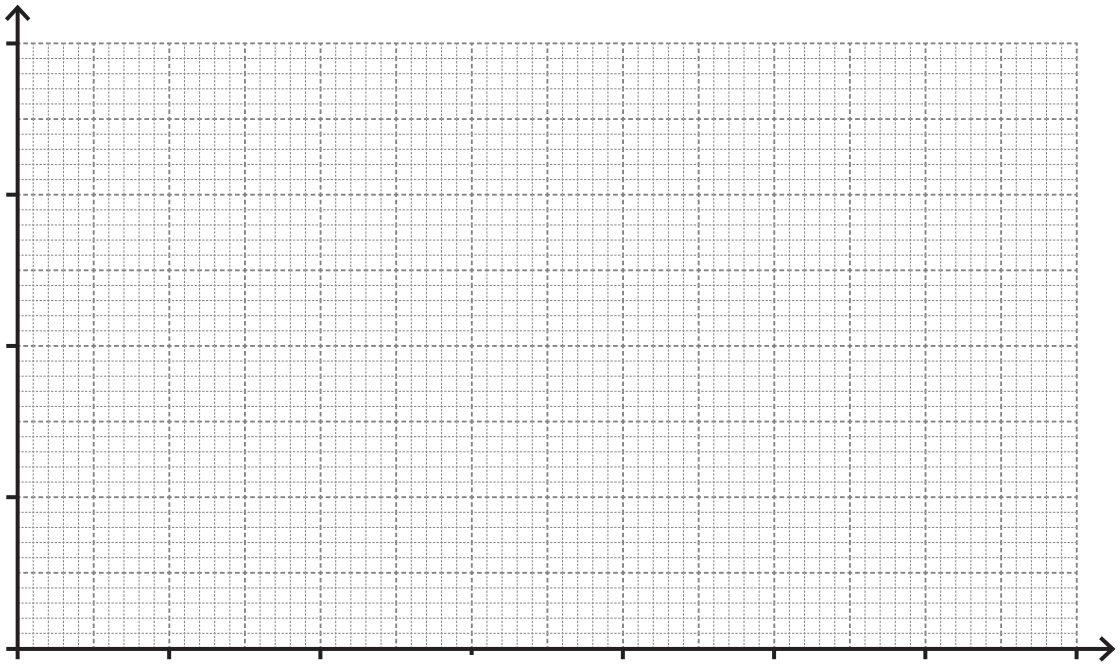
Answer _____ [2]

[Turn over

14 The weights, in grams, of a collection of waste bags from a hospital are shown.

Weight, w (g)	Frequency
$0 < w \leqslant 20$	5
$20 < w \leqslant 30$	8
$30 < w \leqslant 45$	24
$45 < w \leqslant 55$	38
$55 < w \leqslant 95$	64
$95 < w \leqslant 115$	36
$115 < w \leqslant 140$	45

(a) Draw a histogram on the axes provided to illustrate this data.



[3]

(b) Estimate the number of bags which weighed more than 60 g.

Answer _____ [2]

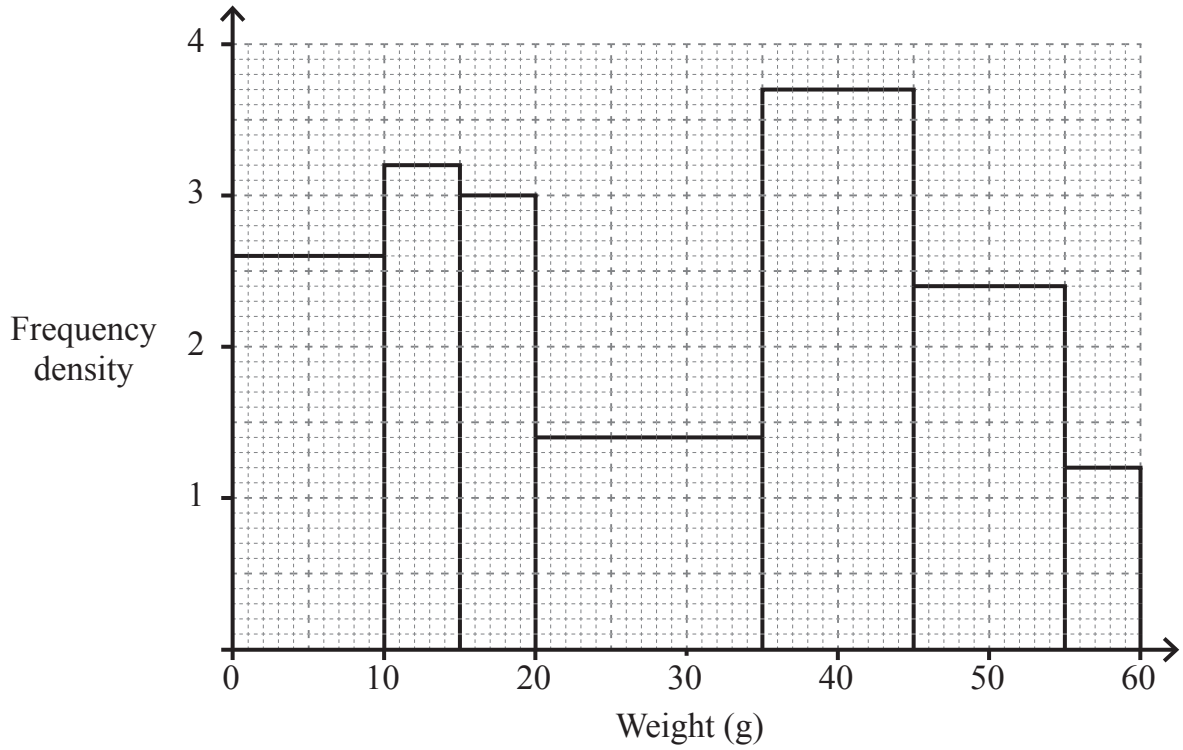
A stratified sample of 70 bags was selected from those with weights less than or equal to 95 g.

(c) Estimate how many of this sample weighed less than 40 g.

Answer _____ [3]

[Turn over

The weights of a second collection of bags are shown in the histogram below.



(d) Estimate the mean weight for this collection.

Answer _____ g [4]

(e) Estimate the median weight for this collection.

Answer _____ g [3]

[Turn over

15 Solve the simultaneous equations

$$x^2 + 5y^2 = 61 \qquad \text{and} \qquad x - 5y = -11$$

A method of trial and improvement will not be accepted.

Answer _____ [8]

16 A is a fraction whose denominator is 3 more than its numerator.

A new fraction B is produced.

4 is added to the numerator of A to give the numerator of B.

4 is added to the denominator of A to give the denominator of B.

Fraction B is now larger than fraction A by $\frac{1}{8}$

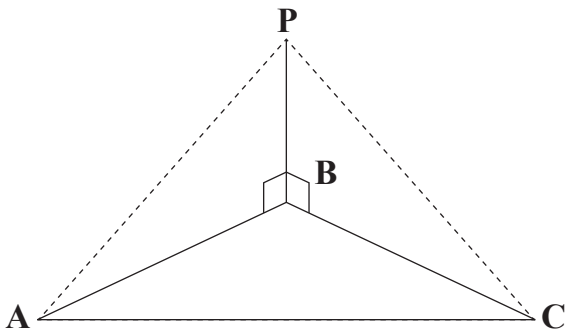
By setting up and solving a suitable equation find the original fraction A.

A method of trial and improvement will not be accepted.

Answer _____ [8]

[Turn over

17



A vertical pole is placed at the corner B of a triangular courtyard ABC.

From point A the angle of elevation of the top of the pole is 16.7°

From point C the angle of elevation of the top of the pole is 14.2°

The side BC is 6 m longer than the side AB.

(a) Calculate the height of the pole.

Answer _____ m [5]

The length of the side AC is 60 m.

(b) Calculate the size of angle ABC.

Answer _____ ° [3]

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For Examiner's use only	
Question Number	**Marks**
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