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New Specification

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2018

Mathematics

Unit M4
(With calculator)
Higher Tier

[GMC41]

GMC41

THURSDAY 24 MAY, 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.**
All working should be clearly shown since marks may be awarded for partially correct solutions.
Where rounding is necessary give answers correct to **2 decimal places** unless stated otherwise.
Answer **all twenty-three** questions.

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.
You may use a calculator.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

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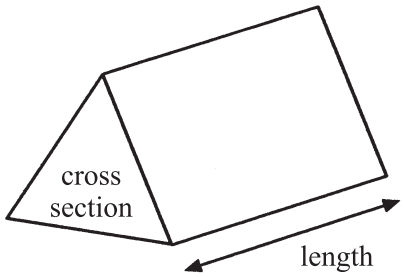
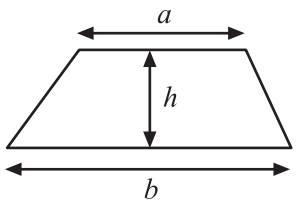
Formula Sheet

Volume of prism = area of cross section × length

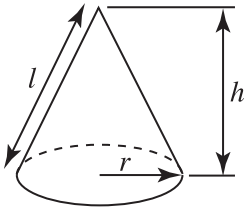


Area of trapezium $= \frac{1}{2}(a+b)h$



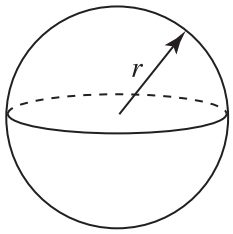
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

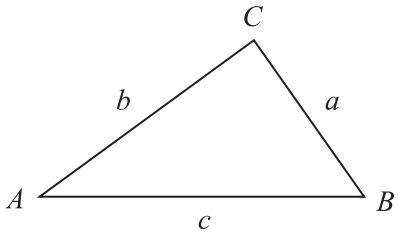


Volume of sphere $= \frac{4}{3}\pi r^3$

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: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

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1 Best Bank offers a 3 year investment account with a fixed compound interest rate of 1.75 % per annum.

Mr Lucas invests £8000 in this account.

What is the value of his investment at the end of the 3 year period?

Answer £ _____ [4]

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2 Last year a company spent a total of £2400 on advertising.

This year they spent £2796

What was the percentage increase in their spending on advertising?

Answer _____% [3]

3 Solve the equation $p + 15 = 2(4p - 3)$

Answer p = _____ [3]

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4 Sue is training to compete in a 10 km walk.

A diagram of her local athletics track is shown below.

The track consists of a rectangle and two semicircles.

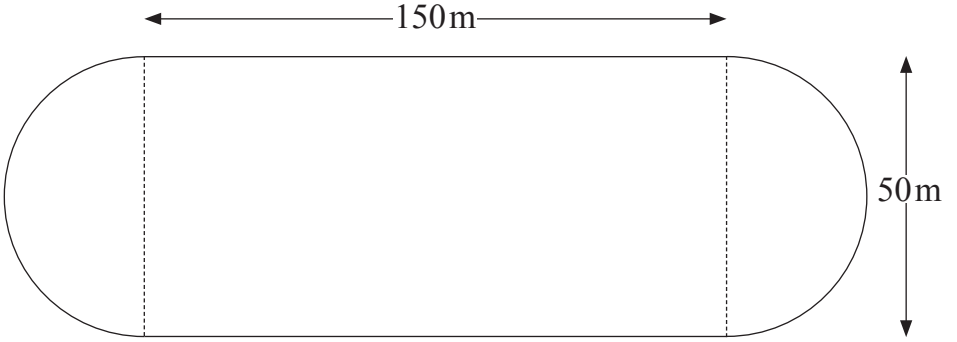

diagram not drawn accurately

How many complete laps are needed to ensure she walks 10 km?

You must show all your working.

Answer _____ [4]

[Turn over

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5 At a concert 40% of the audience are children.

One third of the **rest** of the audience are men.

There are 120 women in the audience.

Work out the total number of people in the audience.

Answer _____ [3]

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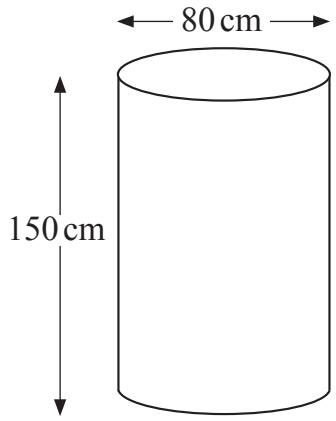
6 **(a)** A cylindrical tank has a diameter of 80 cm and a height of 150 cm as shown.



Calculate the volume of water the tank can hold when full.

Give your answer correct to the nearest litre.

Answer _____ litres [4]

(b) Calculate the curved surface area of the tank.

Answer _____ cm^2 [2]

[Turn over

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7 Peter, John and Matthew are three brothers.

Peter is 10 years old.

John is x years old.

Matthew is a year younger than twice John's age.

The mean of their ages is 7 years.

Work out John's age.

Answer _____ [4]

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8 Which average (mean, mode or median) would be most suitable for each set of data?

Explain your choice.

(a) The data is fairly evenly spread but there is one extreme value at the upper end.

Answer _____ because _____

_____ [1]

(b) One value appears much more frequently than the others and it is not at the upper or lower end of the data.

Answer _____ because _____

_____ [1]

[Turn over

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9 A school timetable is being arranged.

The day can be arranged in 30-minute classes or 50-minute classes or 60-minute classes.

No matter which of the three choices is made, the total daily teaching time will be the same.

Ignoring the time for break or lunch, what is the daily teaching time?

You must show all your working.

Answer _____ [4]

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10 Solve the equation

$$\frac{2x-1}{3} + \frac{x+2}{2} + \frac{x}{6} = 8$$

Show all your working clearly.

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [5]

11 Factorise $y^2 - 6y + 8$

Answer _____ [2]

[Turn over

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12 A man has mass 74 kg and his son has mass 42 kg, both measured to the nearest kilogram.

What is the maximum difference in mass between the man and his son?

Answer _____ kg [2]

13

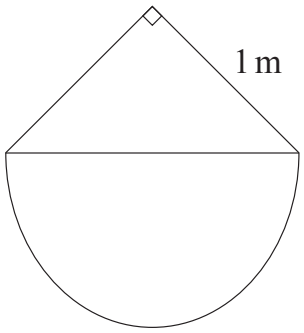

diagram not drawn accurately

The composite shape consists of a right-angled isosceles triangle and a semicircle.

(a) Show that the area of the composite shape is approximately 1.285 m^2

[4]

(b) Find the force applied to the area of the composite shape when the pressure is 5 N/m^2

Answer _____ N [2]

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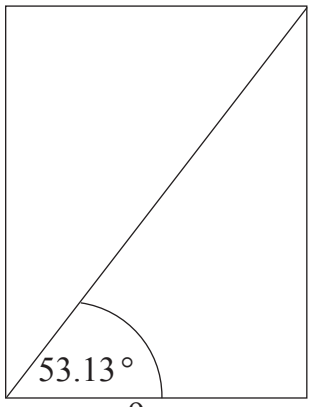
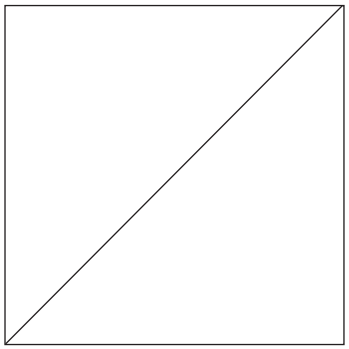
14 A rectangle and a square have the same length of diagonal.





diagrams not drawn accurately

Calculate the length of the side of the square.

Give your answer correct to 1 decimal place.

Answer _____ cm [6]

[Turn over

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15 Factorise fully

$$4q^2 - r^2$$

Answer _____ [2]

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16 The lines STR and BCR are tangents to the circle shown.

Angle RTC = 47° and angle ADC = 94°

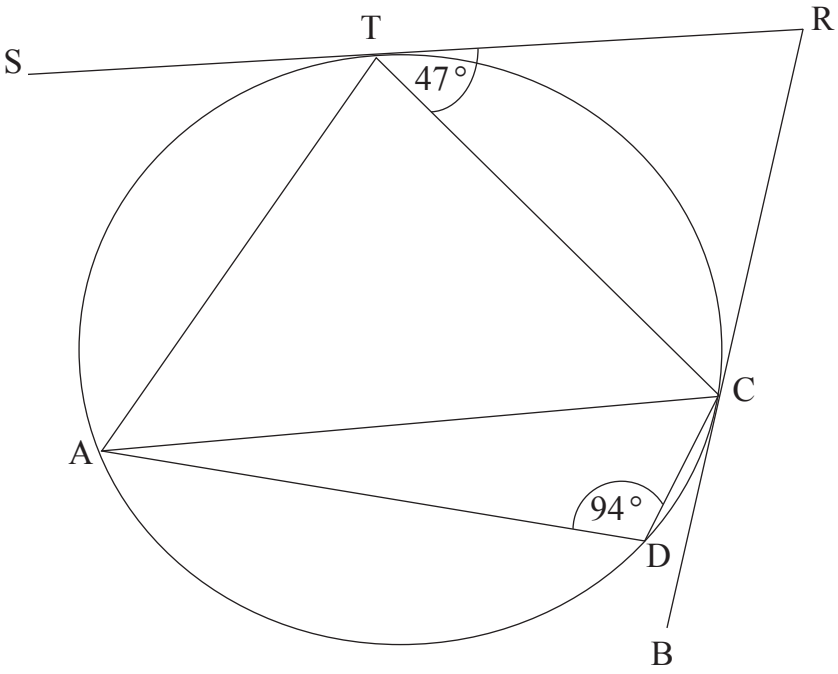

diagram not drawn accurately

John proved that the lines AC and SR are parallel.
He used the following proof but didn't give his reasons.

Using the properties of tangents and circle theorems complete John's argument.

1. Angle RCT = 47° because _____

2. Angle RTC = Angle TAC because _____

3. Angle ATC = 86° because _____

4. Angle STA = 47° because _____

5. So the lines AC and SR are parallel because _____

[5]

[Turn over

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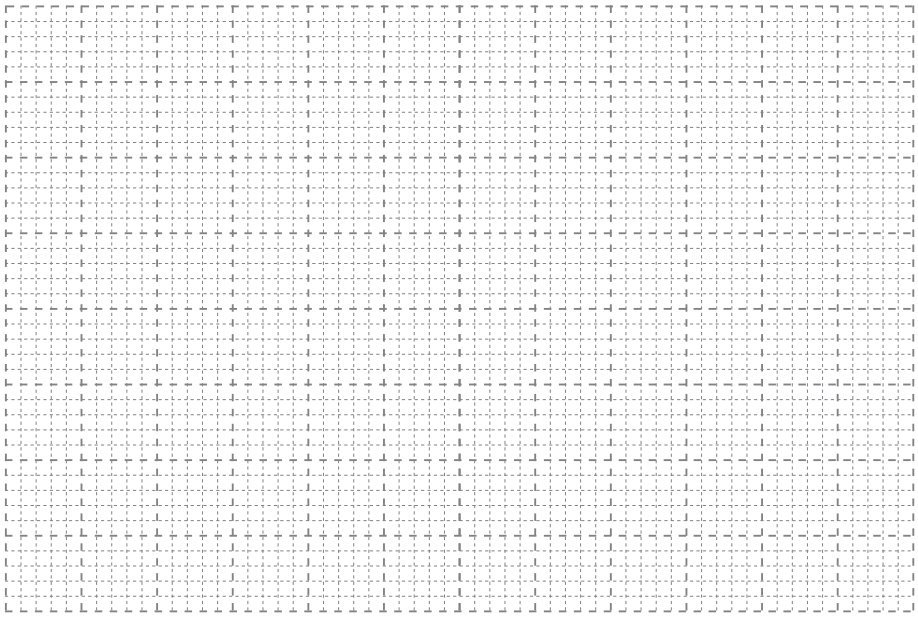
17 The table gives information about the weights of 75 children.

Weight, w kg	Number of Children
$20 \leqslant w < 30$	18
$30 \leqslant w < 36$	15
$36 \leqslant w < 40$	14
$40 \leqslant w < 50$	22
$50 \leqslant w < 65$	6

(a) Illustrate the data by drawing a histogram on the graph paper below.



[3]

(b) A stratified sample of 30 children was taken from those whose weight was less than 40 kg.

Estimate how many of the sample were taken from the interval 30–36

Answer _____ [2]

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18 **(a)** Give a reason why a stratified sample is usually better than a random sample.

_____ [1]

(b) Give a reason why someone might choose to take a random sample rather than a stratified sample.

_____ [1]

19 The length of a rectangular field is 20 m longer than its width.
The area of the field is 406.25 m^2
By setting up and solving a quadratic equation find the length of the field in metres.

A method involving trial and improvement will receive no marks.

Answer _____ m [6]

[Turn over

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20 **(a)** Simplify $\dfrac{x^2 - 4}{3x^2 - 5x - 2}$

Answer _____ [3]

(b) Given $(x + 1)(x - 1) \equiv (x + a)^2 - 6x - b$
find the values of a and b.

Answer a =_____ b = _____ [4]

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21 Solve the equation

$$\frac{3}{3x+5} - \frac{5}{2x+3} = 2$$

Answer _____ [7]

[Turn over

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22 Find the equation of the line L which is perpendicular to the line $3x - 2y + 6 = 0$ and passes through the point $(3, -5)$

Answer _____ [4]

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23 A student prepared a frequency table for an experiment involving measuring weights, w, in grams.

w (grams)	Frequency
$0 \leqslant w < 10$	5
$10 \leqslant w < a$	9
$a \leqslant w < 25$	27
$25 \leqslant w < 30$	14
$30 \leqslant w < 40$	17

The frequency density for the third group in the table was twice the frequency density for the second group.

(a) Find the value of a.

Answer $a =$ _____ [3]

(b) Using this value of a calculate an estimate for the interquartile range of his data.

Answer _____ [5]

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Question Number	**Marks**
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Examiner Number

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