

Centre Numbe												
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General Certificate of Secondary Education 2019

Mathematics

Unit M4 (With calculator)

Higher Tier





[GMC41] *GMC41*

TUESDAY 21 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.

Answer all twenty-two 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.

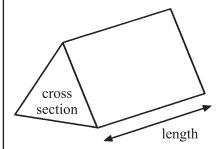
You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on page 2.



Formula Sheet

Volume of prism = area of cross section \times length



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

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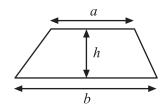
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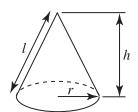
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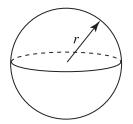
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = πrl

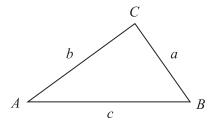


Volume of sphere = $\frac{4}{3}\pi r^3$

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 = $\frac{1}{2} ab \sin C$



Waiting time t (minutes)	Number of patients
$0 < t \le 5$	7
$5 < t \le 10$	8
$10 < t \le 15$	5
$15 < t \le 20$	5
20 < t ≤ 25	4
$25 < t \le 30$	1

Calculate an estimate of the mean waiting time.

Answer _____ minutes [4]

2 Expand and simplify

$$4(2x-3)-2(x-5)$$

Answer _____ [2]

[Turn over

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3	Write 200 as a product of prime factors, using index notation.	
	Answer [3]	
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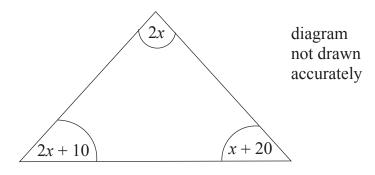
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Form and solve an equation to work out the size of the smallest angle in the triangle above.

Equation _____[1]

Answer smallest angle = $__$ ° [3]

[Turn over

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5 The longest side in a right-angled triangle is 12 cm. One of the shorter sides is 4 cm. Calculate the perimeter of the triangle. Give your answer correct to 1 decimal place. Answer cm [5]			
Calculate the perimeter of the triangle. Give your answer correct to 1 decimal place.			5
Give your answer correct to 1 decimal place.		One of the shorter sides is 4 cm.	
		Calculate the perimeter of the triangle.	
Answer cm [5]		Give your answer correct to 1 decimal place.	
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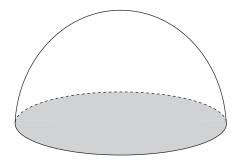


6	(a)	The price of a TV is increased by 20%.
	` /	In a sale this price is decreased by 20%.
		By choosing any starting price for the TV, show that the final sale price is lower than the starting price.
		[3]
	(b)	Calculate the overall percentage decrease.
		Answer % [2]
	(c)	Would the outcome be the same if the 20% decrease was applied first, followed by the 20% increase? Justify your answer.
		[2]
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7 The **solid** hemisphere has a diameter of 12 cm.



Mary says the total surface area is $226\,\mathrm{cm}^2$ to the nearest cm^2

Martha says the total surface area is $339\,\mathrm{cm}^2$ to the nearest cm²

Explain with reasoning who is correct.

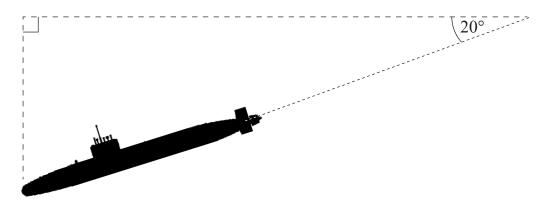
Answer	is correct [A]	1
Answer	is correct [4]	ı

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8 A submarine makes a diving angle of 20° below the horizontal as shown. It travels at a constant speed of 12 m/s.

Work out how deep the front end of the submarine is after one minute.



Answer _____ m [4]

9 Solve the equation $x^2 - x - 12 = 0$

Answer _____ [3]

Turn over

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10 Solve

$$\frac{a-1}{4} + \frac{a+1}{8} = \frac{3}{2}$$

Give your answer as a mixed number.

Answer
$$a = ____[4]$$

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11 Write down the equation of a line parallel to the line with equation y = 3x + 5



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13 160 pupils in Year 8 sat a Science examination at the end of the year.

Their results are given in the cumulative frequency table below.

Examination Mark, x	Cumulative Frequency
$x \le 20$	8
<i>x</i> ≤ 30	18
<i>x</i> ≤ 40	28
<i>x</i> ≤ 50	51
<i>x</i> ≤ 60	96
<i>x</i> ≤ 70	128
<i>x</i> ≤ 80	150
<i>x</i> ≤ 90	160

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(b)	The pas Use you												ils v	vha) n	ass	sed	the	ex	an	niı	nati	on

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14 Stephen wants to survey 50 pupils in his school.

The number of pupils in each year group is given in the table below.

Year 8	Year 9	Year 10	Year 11	Year 12
126	161	154	145	170

For a stratified sample, how many pupils should Stephen include from Year 8?

Show your working out.

Answer	[2]

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15 a = 3.2 and b = 5.8 are both correct to 1 decimal place.

Find

(a) the minimum possible value of b - a,

Answer _____ [1]

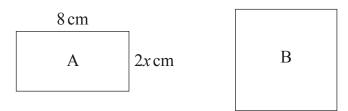
(b) the maximum possible value of $\frac{b}{a}$

Answer _____ [2]

[Turn over



16 A is a rectangle of length 8 cm and width 2x cm, and B is a square.



The perimeters of the rectangle and the square are equal.

(a) Write down an expression in terms of x for the length of the side of the square B.

Answer [2]

The area of the square is $4 \, \text{cm}^2$ more than the area of the rectangle.

(b) (i) Write down an equation satisfied by x and show that it simplifies to

$$x^2 - 8x + 12 = 0$$

[3]

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Talentry Talent	(ii) Solve this equation, giving the ty	vo possible values of x.	
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17 The line l_1 passes through the points (-1, -4) and (2, 8).

The line l_2 is perpendicular to l_1 and passes through the point (1, 1).

Find the equation of the line l_2 in the form y = mx + c.

Answer _____ [5]

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18 The diagram shows a sector AOB of a circle, with radius 13 cm and centre O.

The point C lies on OB and angle ACO is 90°

OC = 5 cm.

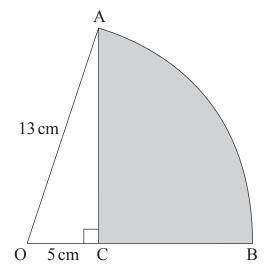


diagram not drawn accurately

Find the area of the shaded section ABC.

Answer _____ cm² [8]

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19 Solve the equation

$$\frac{4}{x+3} - \frac{3}{x+4} = 1$$

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Answer _____ [6]





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20 The table and histogram show information about the length of time 230 pupils spent on social media on a week night.

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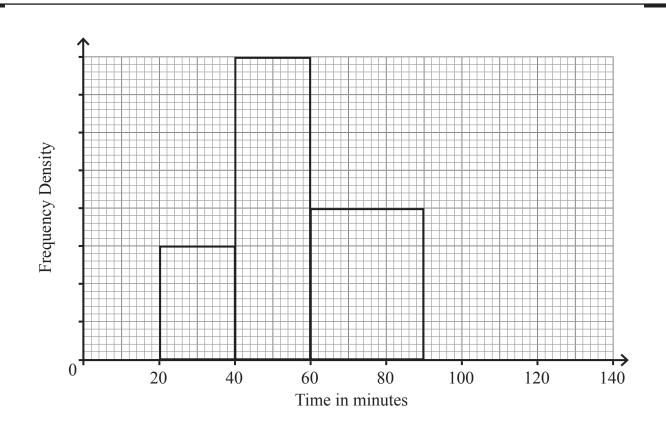
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No pupil spent more than 120 minutes on social media on a week night.

Length of time in minutes, m	Frequency
$0 < m \le 10$	10
$10 < m \le 20$	25
$20 < m \le 40$	
40 < m ≤ 60	80
$60 < m \le 90$	60
90 < m ≤ 100	
$100 < m \le 120$	10





(a) Complete the table and the histogram.

[6]

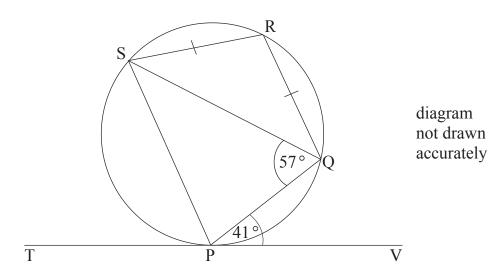
(b) Use the histogram to estimate the median time spent on social media.

Answer _____ minutes [2]

[Turn over



21



TV is a tangent to the circle at P.

SR = RQ

Angle QPV = 41° and angle SQP = 57°

Show that SP is parallel to RQ.

You must give reasons to justify any angles that you calculate.

[5]

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22 (a) Factorise $2a^2 + 7ab - 4b^2$

Answer _____ [2]

(b) Simplify the following

$$\left(\frac{x+1}{2x-1} + \frac{3x-4}{x-4}\right) \times \frac{2x-1}{x}$$

Answer [4

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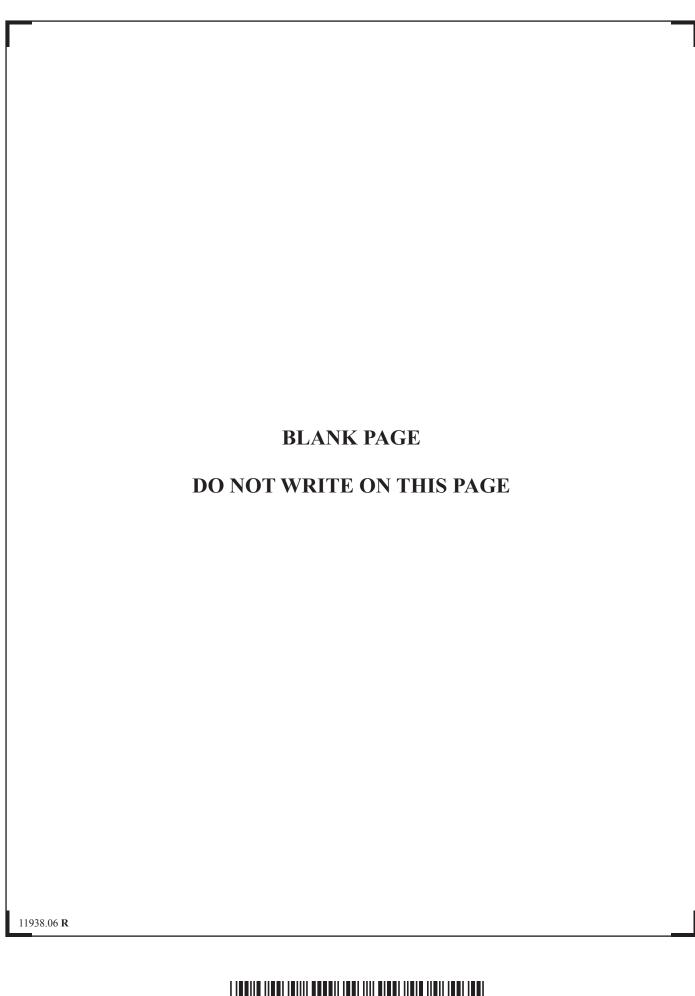
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