



General Certificate of Secondary Education
2019

Centre Number

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Candidate Number

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Mathematics

Unit M3
(With calculator)
Higher Tier



[GMC31]

GMC31

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-six** 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.

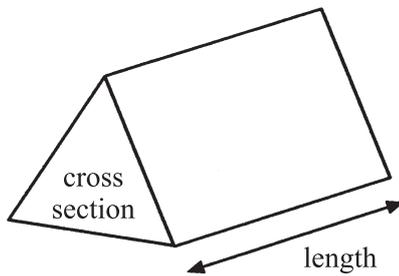
You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on page 2.

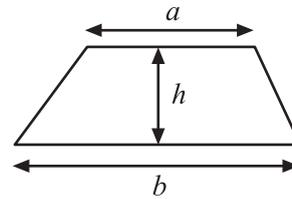


Formula Sheet

Volume of prism = area of cross section \times length

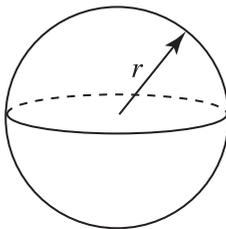


Area of trapezium = $\frac{1}{2}(a+b)h$



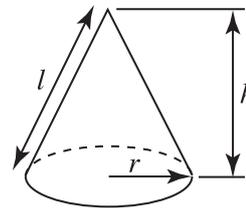
Volume of sphere = $\frac{4}{3}\pi r^3$

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

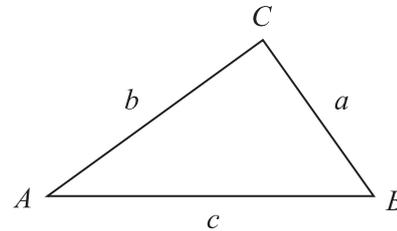


Volume of cone = $\frac{1}{3}\pi r^2 h$

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



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



1 Tickets for a show are priced as shown:

Adult	£14	Senior Citizen	£8	Child	£5
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Mrs Evans spent £57 on 6 tickets.

She bought 1 Child ticket.

How many Adult and Senior Citizen tickets did she buy?

Answer Adult _____

Senior Citizen _____ [3]

[Turn over



- 2 Gary asked some people how many times they went to the cinema last month.

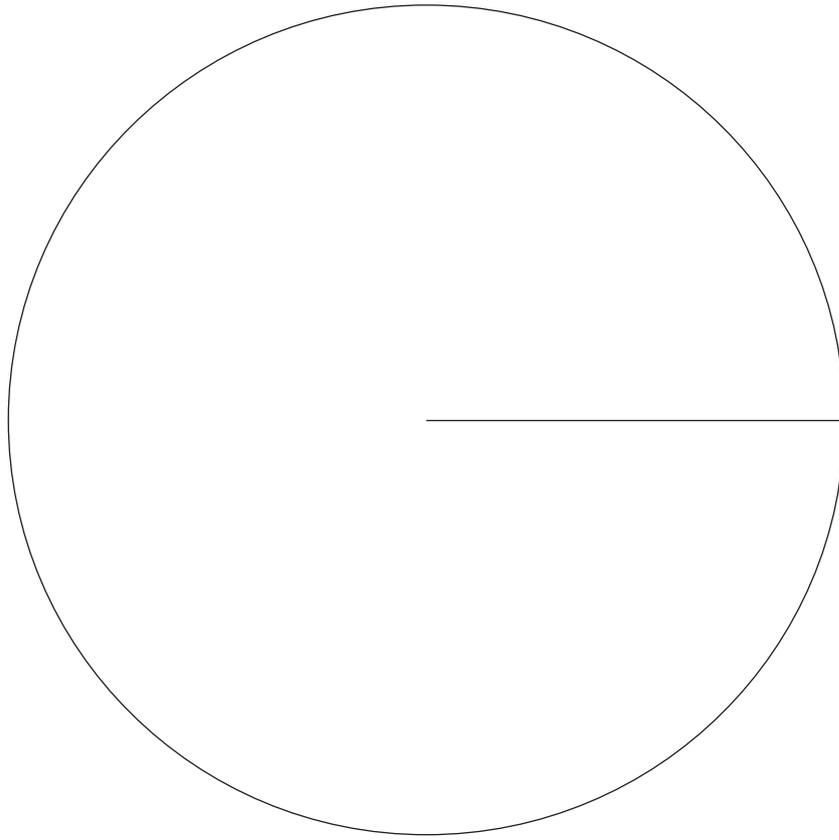
Number of times	Number of people
Less than 3	0
3	5
4	11
5	8
6	6
More than 6	0

- (a) How many times did these people go in total?

Answer _____ [2]



(b) Draw a fully labelled pie chart to show the information in the table.



[4]

[Turn over



3 Steven wants to get a T-shirt printed for each member of his running club.

The printer charges a fee of £25 to set up the machine.

He then charges £1.20 per T-shirt for the printing.

The total bill from the printer was £67

How many people are in the running club?

Answer _____ [3]



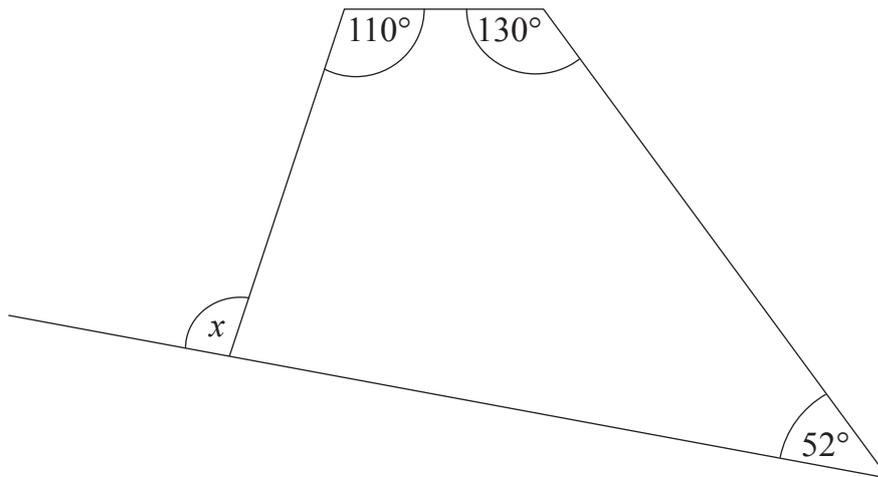
- 4 Jenny opens a “Charity Bank Account”. Any interest gained goes to a local charity.
It pays 2% per annum simple interest.
She puts £1500 into the account.
She does not make any deposits or withdrawals.
How much interest will the charity have received after 3 years?

Answer £ _____ [3]

[Turn over



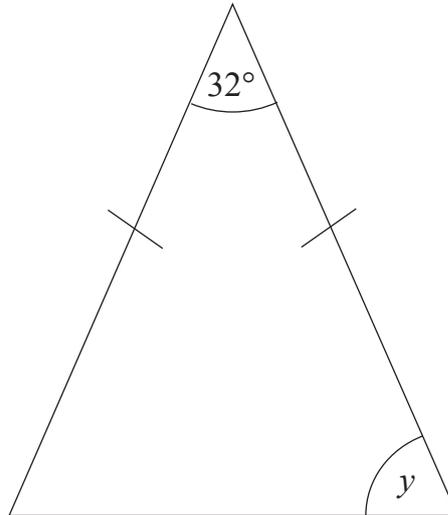
- 5 (a) Work out the size of the angle x in the diagram below.



Answer _____ $^\circ$ [3]



(b) Work out the size of the angle y in the diagram below.



Answer _____ $^\circ$ [2]

[Turn over



6 Peter buys mince and potatoes.

Mince costs £6 per kg.

Peter buys 3.2 kg of mince and 1.8 kg of potatoes.

The total cost is £20.46

How much does it cost for 1kg of potatoes?

Answer _____ p [4]



7 Holly did three exams.

Her results were:

Geography 28 out of 40

Music 16 out of 25

English 34 out of 50

Her Mum says “English was your best subject.”

Is her Mum right?

You must show your working and explain your answer.

Answer _____ because _____
_____ [3]

[Turn over



8 Mr Jackson's car insurance is £840

He can either:

pay the full amount within seven days and receive 5% discount

or

pay by direct debit, which will cost 8% more.

The direct debit is paid in 12 equal monthly amounts.

(a) If he chooses direct debit, how much will his monthly payment be?

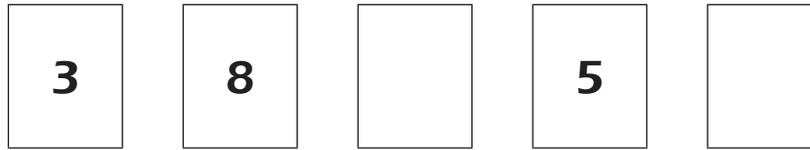
Answer £ _____ [3]

(b) How much extra will he pay if he chooses the direct debit instead of paying in full within seven days?

Answer £ _____ [2]



9 Alice has five cards each with a number on them. Three of the numbers are shown.



The mode of the five numbers on the cards is 5

The mean of the five numbers on the cards is 6

Work out the range of the five numbers on the cards.

You must show your working.

Answer _____ [4]

[Turn over



10 Factorise

(a) $8b + 12$

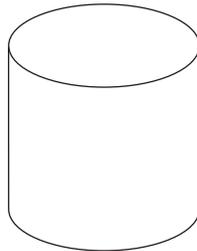
Answer _____ [1]

(b) $t^2 - t$

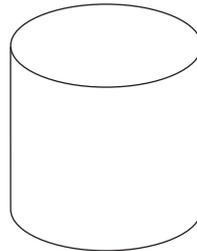
Answer _____ [1]



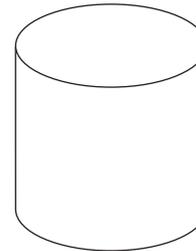
11 Three identical barrels are collecting rainwater.



A



B



C

Barrel A is $\frac{3}{4}$ full.

Barrel B is $\frac{5}{6}$ full.

Barrel C is $\frac{2}{3}$ full.

The water in Barrel C is poured into Barrels A and B.

Can Barrels A and B be filled?

You must show working to justify your answer.

Answer _____ because _____

_____ [4]

[Turn over



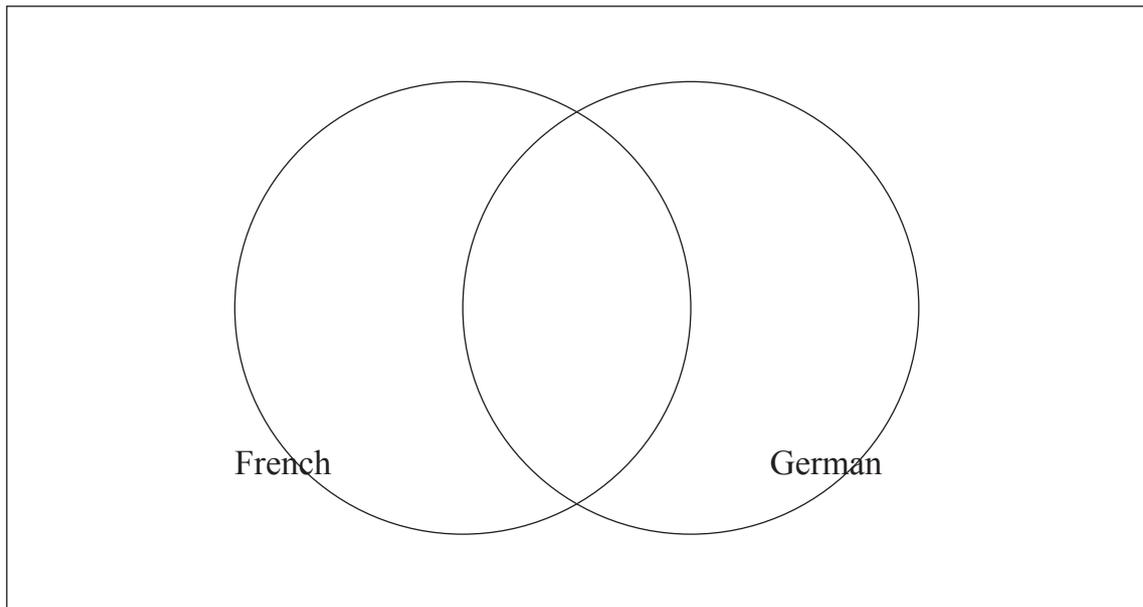
- 12 In Year 11 there are 200 students.
Students can choose to study French, German, both languages or no language.

95 students study French.

75 students study German.

35 students study both languages.

By completing the Venn diagram below, calculate how many students in Year 11 study no languages.



Answer _____ [4]



13

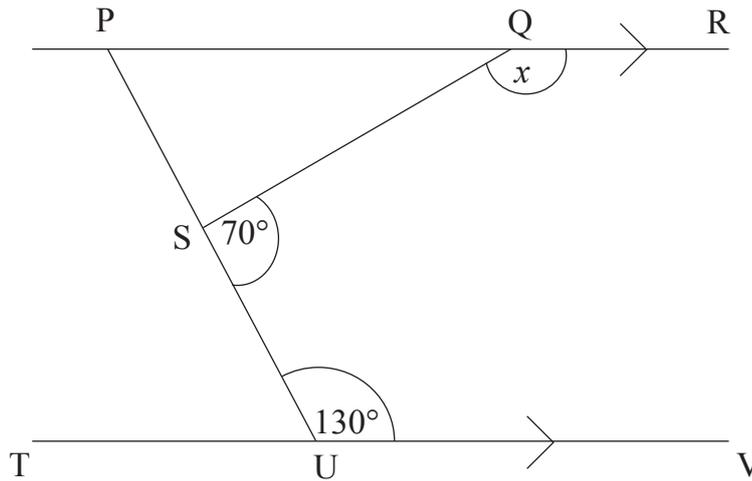


diagram
not drawn
accurately

PR and TV are parallel lines.

Calculate the size of angle x .

Answer _____° [3]



14 The waiting times for patients at a surgery are recorded in the table.

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

(a) Write down the modal class.

Answer _____ [1]

(b) Calculate an estimate of the mean waiting time.

Answer _____ minutes [4]



15 Expand and simplify

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

Answer _____ [2]

16 Write 200 as a product of prime factors, using index notation.

Answer _____ [3]

[Turn over



17

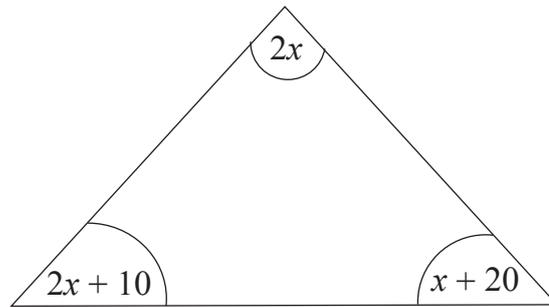


diagram
not drawn
accurately

Form and solve an equation to work out the size of the smallest angle in the triangle above.

Equation _____ [1]

Answer smallest angle = _____° [3]



18 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]



19 (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.

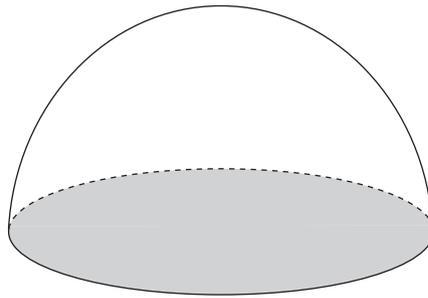
Answer _____ % [2]

(c) Would the outcome be the same if the 20% decrease was applied first, followed by the 20% increase? Justify your answer.

[2]



20 The **solid** hemisphere has a diameter of 12 cm.



Mary says the total surface area is 226 cm^2 to the nearest cm^2

Martha says the total surface area is 339 cm^2 to the nearest cm^2

Explain with reasoning who is correct.

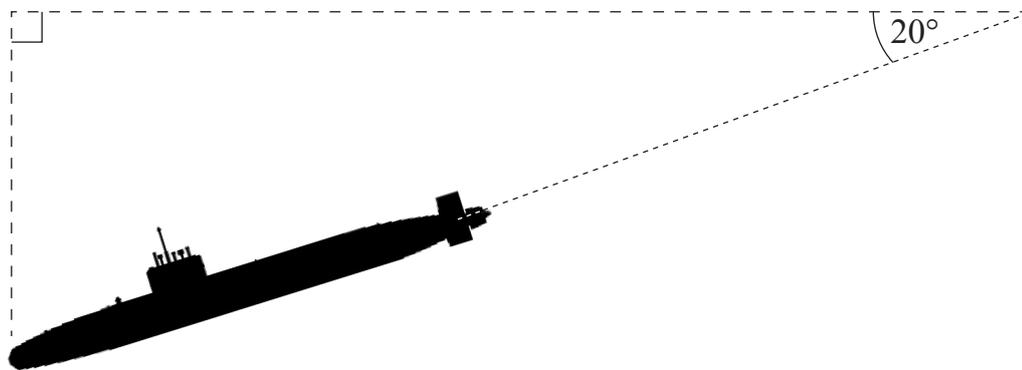
Answer _____ is correct [4]

[Turn over



- 21 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]

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

Answer _____ [3]



23 Solve

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

Give your answer as a mixed number.

Answer $a =$ _____ [4]

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

Answer _____ [2]

[Turn over



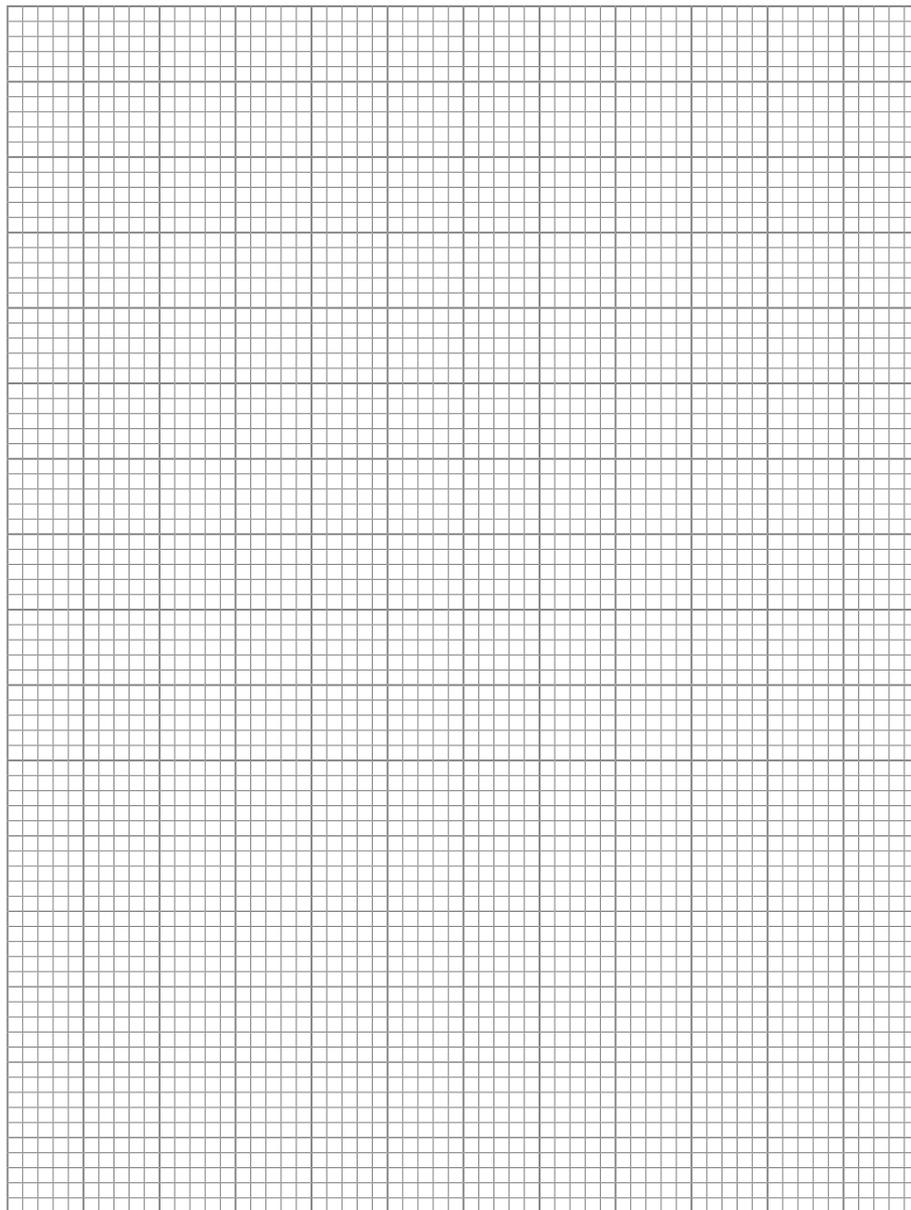
25 160 pupils in Year 8 sat a Science examination at the end of the year.

Their results are given in the cumulative frequency table below.

Examination Mark, x	Cumulative Frequency
$x \leq 20$	8
$x \leq 30$	18
$x \leq 40$	28
$x \leq 50$	51
$x \leq 60$	96
$x \leq 70$	128
$x \leq 80$	150
$x \leq 90$	160



(a) On the graph paper below draw a cumulative frequency graph for the data given.



[3]

(b) The pass mark for this examination was 55

Use your graph to estimate the number of pupils who passed the examination.

Answer _____ [2]

[Turn over



26 After a 7.5% pay rise Mr Jones' salary was £29 455

What was his salary before the pay rise?

Answer £ _____ [3]

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For Examiner's use only	
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Total Marks	
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Examiner Number

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