



General Certificate of Secondary Education
January 2020

Centre Number

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Candidate Number

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Mathematics

Unit M3
(With calculator)
Higher Tier



[GMC31]

GMC31

MONDAY 13 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 twenty-seven** 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.

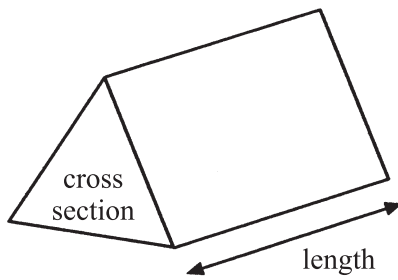
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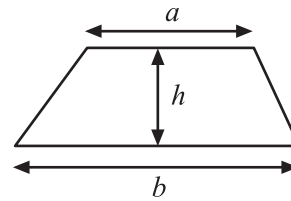
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Formula Sheet

Volume of prism = area of cross section \times length

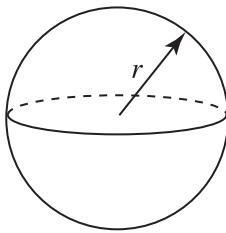


Area of trapezium = $\frac{1}{2}(a+b)h$



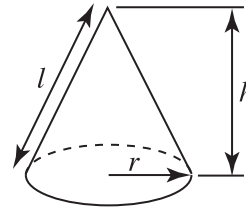
Volume of sphere = $\frac{4}{3}\pi r^3$

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

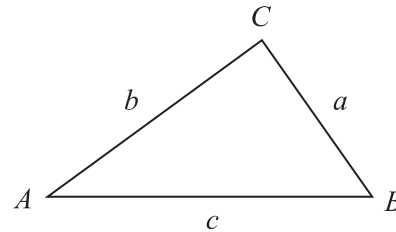


Volume of cone = $\frac{1}{3}\pi r^2 h$

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

Silverside costs £4.90 per kg

Topside costs £5.75 per kg

Fillet costs £13.00 per kg

Martin buys 4.5 kg of Fillet.

He also buys some Silverside.

The total cost is £92.31

How much Silverside does he buy?

Answer _____ kg [4]

[Turn over

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2 (a) Calculate the value of $\frac{2}{0.4^2}$

Answer _____ [2]

(b) Calculate the cube of 6

Answer _____ [1]

(c)

36	1	19	49	10	39	15	31
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From the numbers in the list, write down all the

(i) prime numbers,

Answer _____ [1]

(ii) square numbers.

Answer _____ [1]

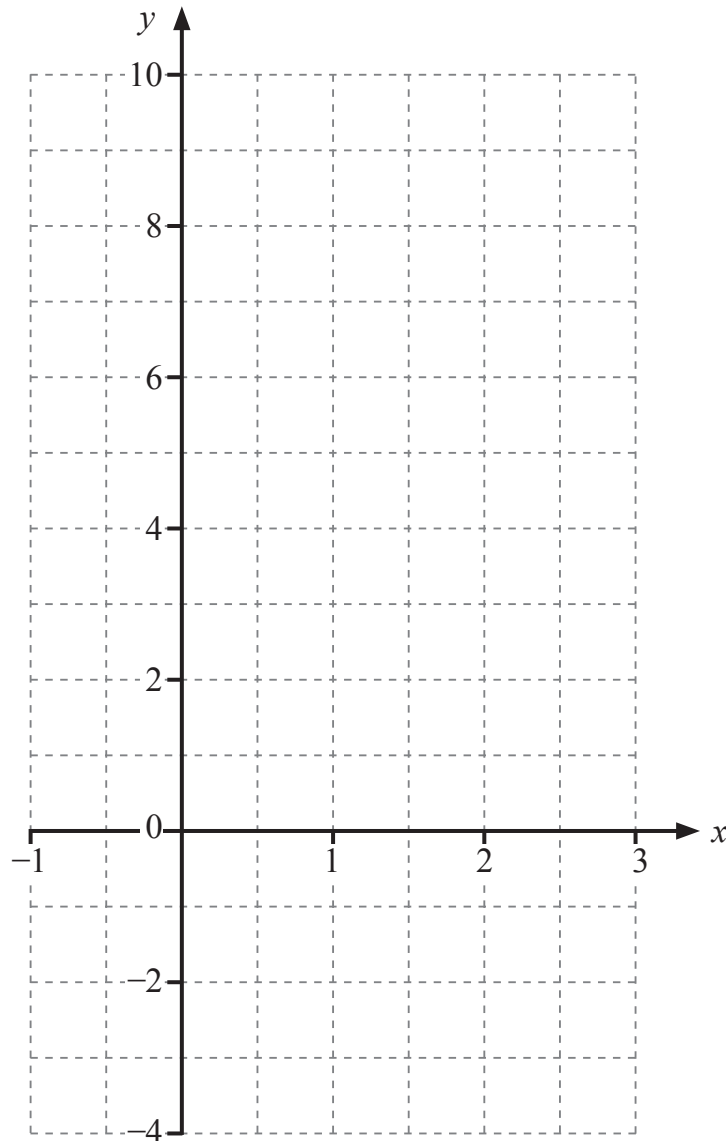


3 (a) Complete the table below for $y = 4x - 3$

x	1	2	3
y			

[1]

(b) Draw the line $y = 4x - 3$ on the grid below



[2]

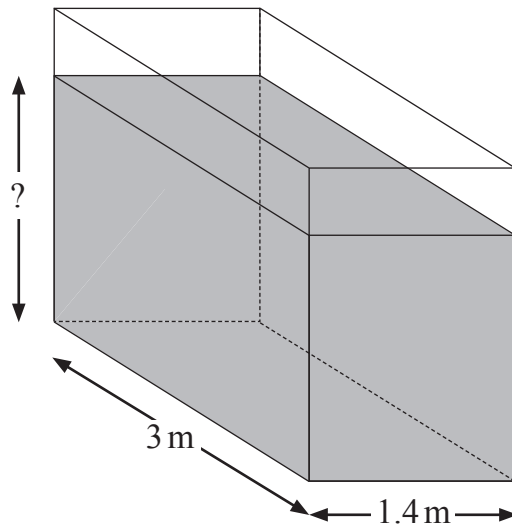
[Turn over



4 A tank is in the shape of a cuboid, as shown below.

The tank is used to store 11.13 m^3 of liquid.

How deep is the liquid in the tank?



Answer _____ m [3]



5 Work out the size of the angle marked x in the diagram below.

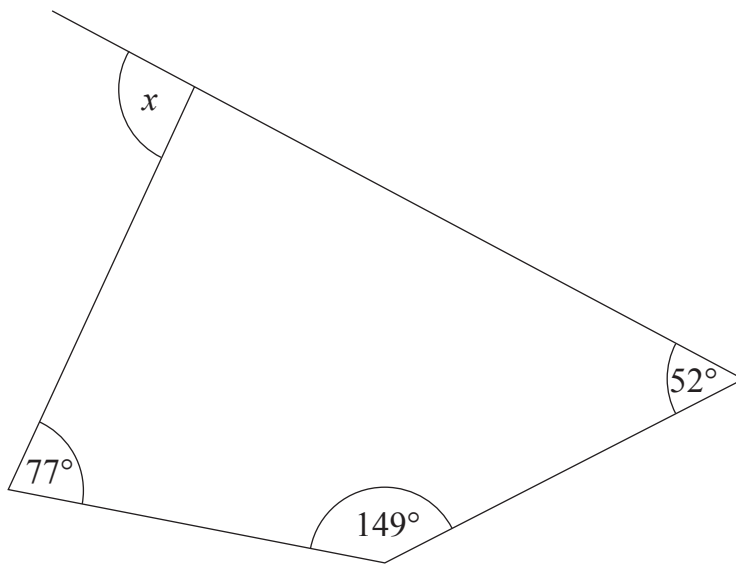


diagram not
drawn accurately

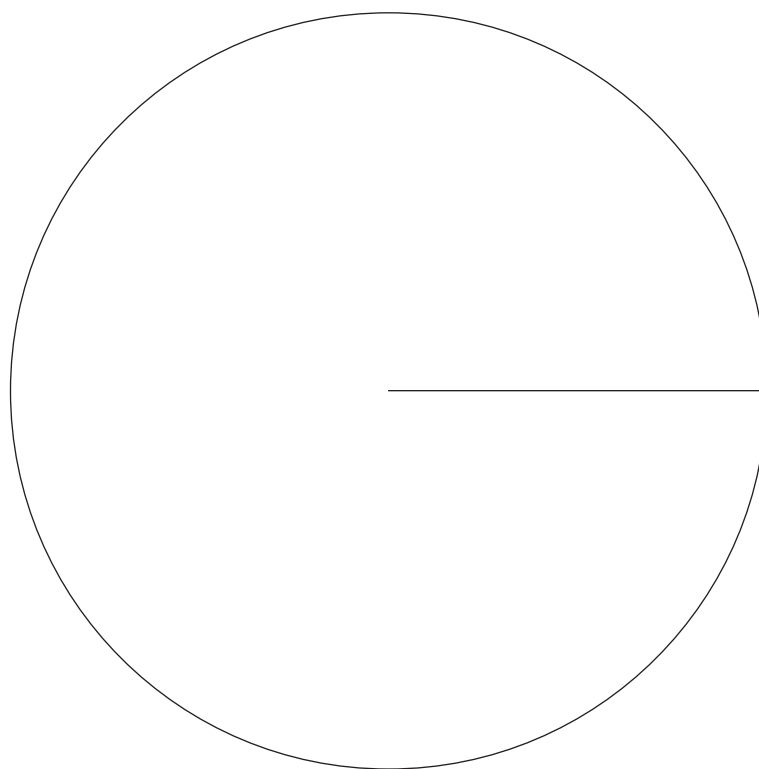
Answer _____ $^\circ$ [3]



6 The total sales figures for a supermarket one month are shown below.

Department	Total Sales (£1000s)	
Food	65	
Electrical	32	
Clothing	46	
Household	23	
Health & Beauty	14	

Draw a pie chart to show this information.



[4]



7 A hotel has single, twin and family rooms.

It offers room only, bed and breakfast (B&B) or half board.

On Saturday night, all the rooms in the hotel were booked.

Some information is shown in this two-way table.

	Room only	B&B	Half board	
Single	2	1		4
Twin		4	3	
Family	1		6	10
	7			

How many rooms are in the hotel?

Answer _____ [3]

[Turn over



8 Streetwise Youth Club has 86 members.

59 of the members attended last week.

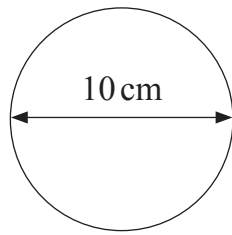
What percentage attended last week?

Give your answer to 1 decimal place.

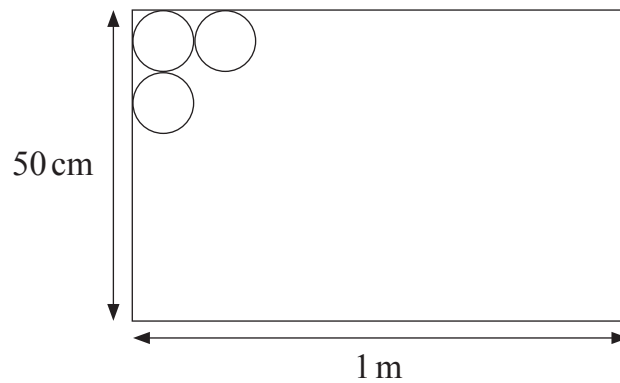
Answer _____ % [3]



9 Circles with diameter 10 cm are cut from a sheet of plastic as shown below.



diagrams not
drawn accurately



(a) Calculate the area of each circle.

Answer _____ cm^2 [2]

(b) How many circles can be cut from the sheet of plastic?

Answer _____ [2]

(c) What is the area of the plastic left over after the maximum number of circles have been cut out?

Answer _____ cm^2 [3]

[Turn over



10 Julie works on a market stall.
One Saturday she has 42 boxes of candles to sell.
Each box cost her £2.40
There are 18 candles in each box.

During the day she sells 34 boxes at £3.60 each.
In the last hour she starts to sell the remaining candles individually at 35p each.

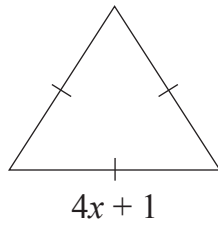
At the end of the day she has only 12 candles left.
Calculate the profit she made that day.

Answer £ _____ [6]

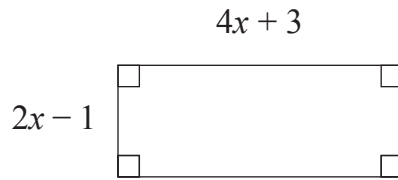


11 Which of these shapes has the greatest perimeter?

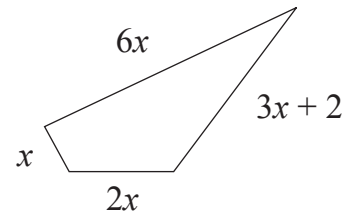
Show all your working.



Shape A



Shape B



Shape C

Answer Shape _____ [4]

[Turn over



- 12 A shop sells 80 gift vouchers valued at £5, £10, £20, £50 or £100
The table shows the number of each sold one weekend.

Price of gift voucher	Number of vouchers sold	
£5	34	
£10	26	
£20	9	
£50	7	
£100	4	

The shopkeeper states “on average people spend at least £15 on a gift voucher”.

By finding all three averages (mode, median, mean), which average makes her statement correct?

Answer _____ because _____

_____ [5]



13 BMI (Body Mass Index) is calculated using the formula

$$\text{BMI} = \frac{w}{h^2}$$

where w = weight in kilograms and h = height in metres.

Mark has a BMI of 22

His height is 1.83 m.

Calculate his weight.

Answer _____ kg [2]

14 Solve $5(3x - 2) = 7x + 4$

Answer $x =$ _____ [3]

[Turn over



- 15 A badge is made from a triangle and three-quarters of a circle as shown.

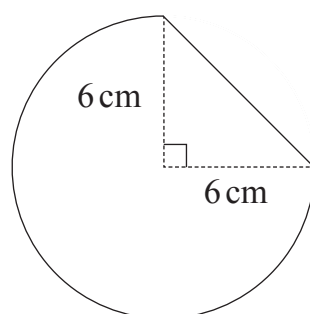


diagram not
drawn accurately

Work out the perimeter of the badge.

Answer _____ cm [6]



16 Write down two numbers, greater than 1, which have a lowest common multiple (LCM) of 48

Answer _____, _____ [2]

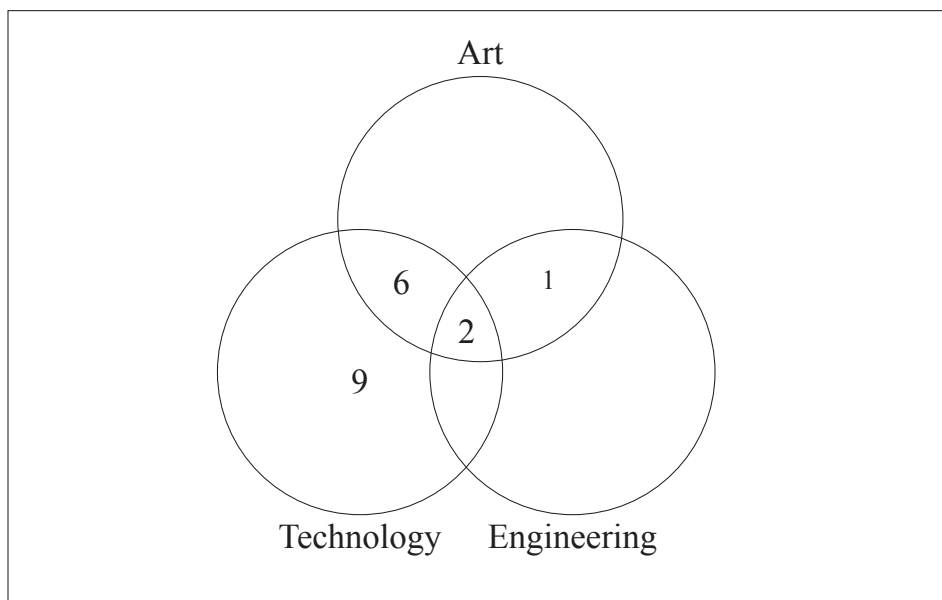
17 Expand and simplify $(p - 6)(p + 2)$

Answer _____ [2]



- 18 There are 35 students in a Form Class.
Some students study Art, some study Technology, some study Engineering and some study a combination of these subjects.
Some study none of these subjects.

The Venn diagram shows some information about the number of students studying the subjects.



- 5 students study Technology and Engineering.
14 students study Art.
8 students study Engineering.

- (a) Use this information to complete the Venn diagram. [4]
- (b) Use the Venn diagram to calculate what percentage of Technology students also study Art but not Engineering.

Answer _____ % [2]

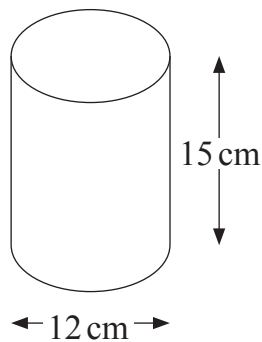


19 Work out the midpoint of the line PQ joining P(4, -6) and Q(8, 2).

Answer (_____ , _____) [2]

20 Calculate the volume of a cylinder with diameter 12 cm and height 15 cm.

Include units with your answer.



Answer _____ [3]

[Turn over



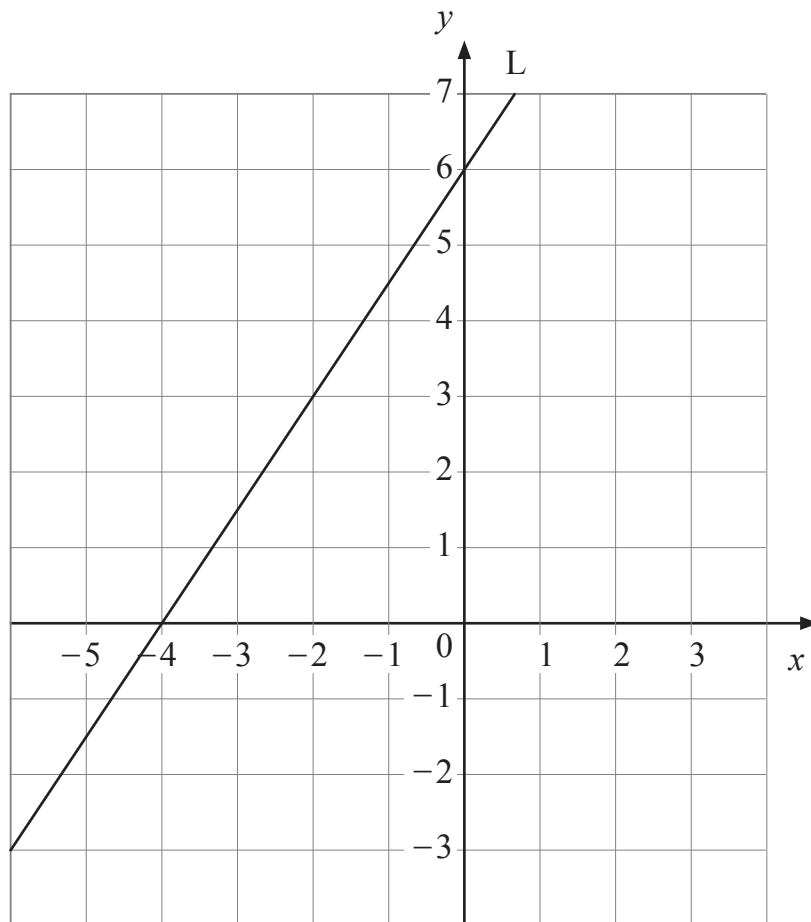
- 21 A restaurant bill, including 15% service charge, was £98.90
How much was the service charge?

Answer £ _____ [3]

22 Simplify $\frac{x^2 - 2x}{3} \times \frac{6}{x^2 + 2x - 8}$

Answer _____ [3]





(a) Write down the equation of the line L shown.

Answer _____ [3]

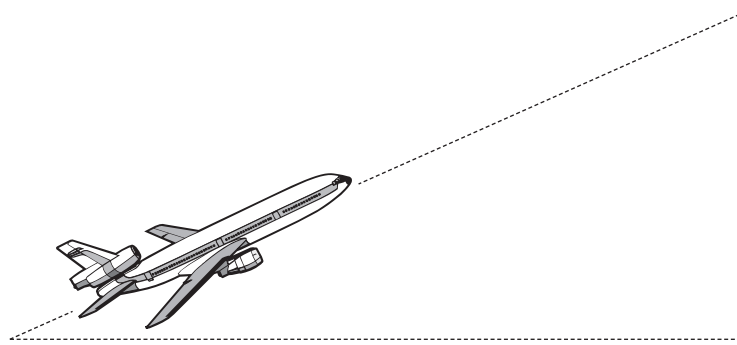
(b) Write down the equation of any line parallel to line L.

Answer _____ [1]

[Turn over



24 After take-off, an aircraft flies for 16 km at an angle of 24° to the horizontal.



Calculate the height it reaches.

Answer _____ km [3]



26 (a) Write 84 and 154 as a product of their prime factors.

Answer 84 = _____ 154 = _____ [2]

(b) Hence, or otherwise, find the highest common factor (HCF) of 84 and 154

Answer _____ [2]



27 Rory has x golf balls.

Graham has one less than Rory.

Darren has one less than Graham.

After a round of golf, Rory still has x golf balls but Graham has lost half of his golf balls and Darren has lost two-thirds of his golf balls.

They **now** have a total of 74 golf balls between them.

Set up a linear equation and solve it to find how many golf balls each player now has.

A solution by trial and improvement will not be accepted.

Answer Rory _____ Graham _____ Darren _____ [5]

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