



GCSE BITESIZE examinations

General Certificate of Secondary Education

Specimen paper

**MATHEMATICS
HIGHER TIER**

Paper 2 Calculator

Time allowed: 1 hour 45 minutes

Answer all questions in the space provided.

**Mark allocations are shown in brackets.
The maximum mark for this paper is 110.**

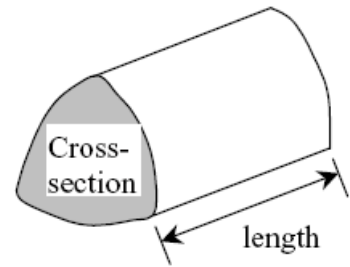
Show clearly how you work out your answer.

In addition to this paper, you will require:

- calculator
- ruler graduated in centimetres and millimetres
- protractor
- compasses
- pen
- HB pencil
- eraser
- tracing paper (optional)

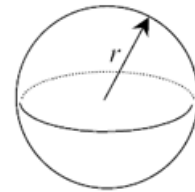
Formula sheet: Higher Tier
You may use the following formulas:

Volume of prism = area of cross section \times length



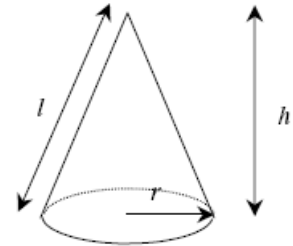
Volume of sphere = $\frac{4}{3} \pi r^3$

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



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

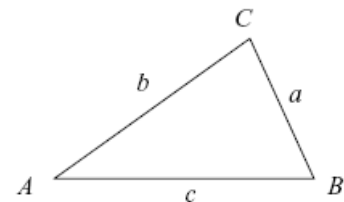
Curved surface area of cone = $\pi r l$



In any triangle ABC

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

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



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

The quadratic equation

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

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

Answer **all** questions in the spaces provided.

1. Calculate the value of $\frac{3.46^3 + \sqrt{2.3^2 + 1}}{2.7} + 3.6$

Give your answer correct to 3 significant figures.

Answer:..... (3 marks)

2. Sam uses 140g of flour to make 12 cakes.
How much flour will Sam need to make 21 cakes?

Answer:.....g (2 marks)

3. (a) Write the following in standard form:

(i) $156,700,000 = \dots\dots\dots$

(ii) $0.000341 = \dots\dots\dots$ (1 mark)

(b) Write the following without standard form:

(i) $2.6 \times 10^5 = \dots\dots\dots$

(ii) $9.02 \times 10^{-3} = \dots\dots\dots$ (1 mark)

(c) Calculate the value of the following, giving your answer in standard form:

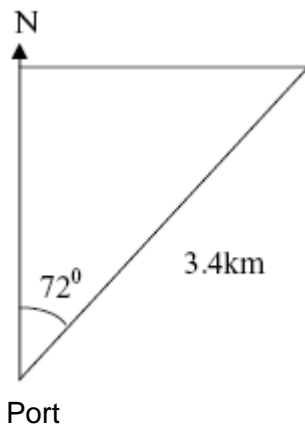
$\frac{2.76 \times 10^3}{6.9 \times 10^{-2}} = \dots\dots\dots$ (2 marks)

4. Rearrange the following, making c the subject:

$$\frac{3c + b}{2} = c + a$$

..... (3 marks)

5. A ship sets off on a bearing of 072° from port and travels 3.4km in a straight line. How far north of the ship's starting position is its final position? Give your answer to 2 decimal places.



.....km (3 marks)

6. Complete the following:

(a) $4\text{m} = \dots\dots\dots\text{km}$ (1 mark)

(b) $30\text{ litres} = \dots\dots\dots\text{ml}$ (1 mark)

(c) $8\text{cm}^2 = \dots\dots\dots\text{mm}^2$ (2 marks)

7. A plasma screen television is being sold by two companies:
Plasma-4-U is charging £1599 including VAT.
Commercial Displays Limited is charging £1526 + VAT.
What is the difference in price to the customer (including VAT)?
[VAT is charged at 17.5%]

Answer: £..... (3 marks)

8. Simplify:

(a) $(3x^2y^3)^3$

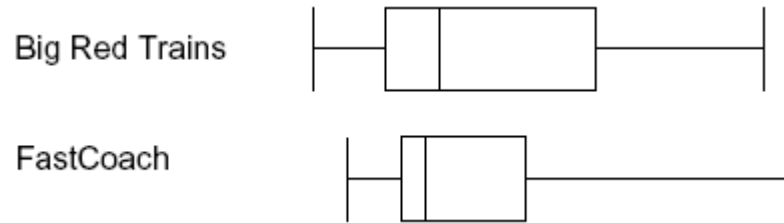
Answer:..... (2 marks)

(b) $\frac{x^2 + 4x}{x^2 + 3x - 4}$

Answer:..... (3 marks)

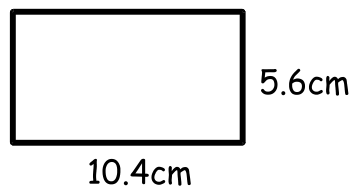
9. The two box plots give data about the journey time from Birmingham to Manchester of trains run by two different companies. Give a reason, supported by the two different statistics, to suggest why one of the companies is better.

Journey time from London to Manchester



.....(4 marks)

10. The dimensions of this rectangle are given correct to the nearest mm.



Calculate the greatest and least values for the area of the rectangle.

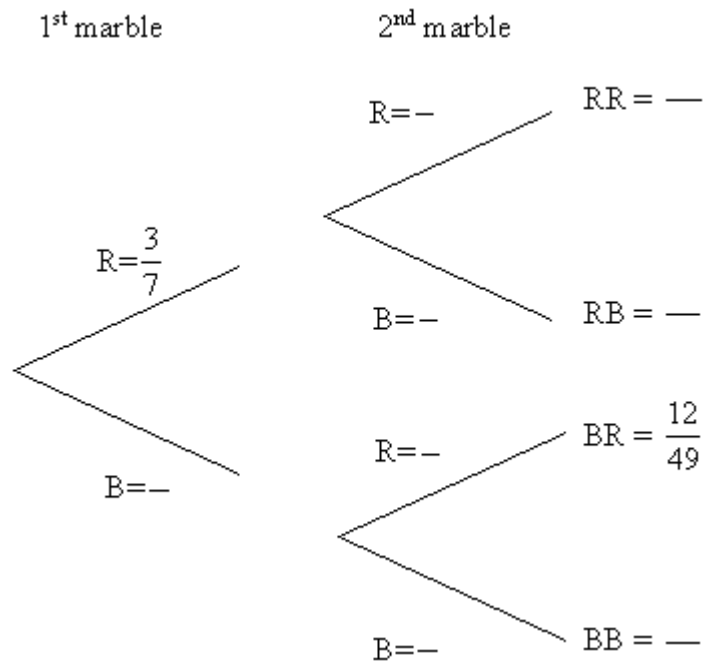
Greatest = cm² (2 marks)

Least = cm² (2 marks)

11. The equation $x^3 - x^2 = 40$ has a solution between $x = 3$ and $x = 4$. Use trial and improvement to find the value of x , giving your answer correct to 1 decimal place. Show all your working.

Answer:..... (4 marks)

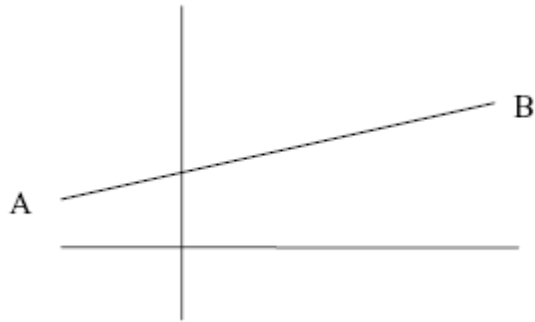
12. A bag contains 7 coloured marbles. 3 of them are red, and the remainder are blue. Two marbles are removed from the bag, one at a time, replacing the first marble before the second is drawn.
 (a) Complete the tree diagram for this situation. (3 marks)



- (b) Find the probability that both balls drawn are the same colour.

..... (2 marks)

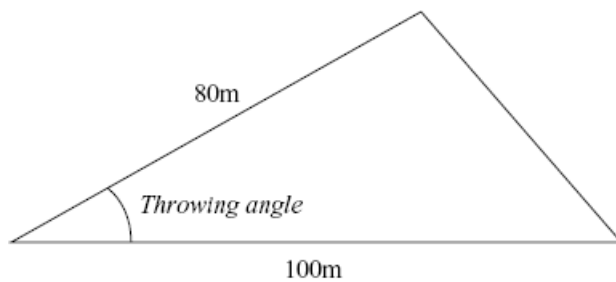
13. Find the midpoint and the length to 2 decimal places of the line AB, given that $A = (-2, 1)$ and $B = (5, 3)$.



Midpoint..... (2 marks)

Length..... (2 marks)

14. A javelin throw can be modelled as a triangle for training purposes. A trainer suggests that if the thrower can get the javelin to fly 80m to its highest point, then 60m as it's coming down, a long throw will result. If the thrower succeeds in following this advice, what throwing angle is needed to achieve a world record throw of 100m (round to one decimal place)?

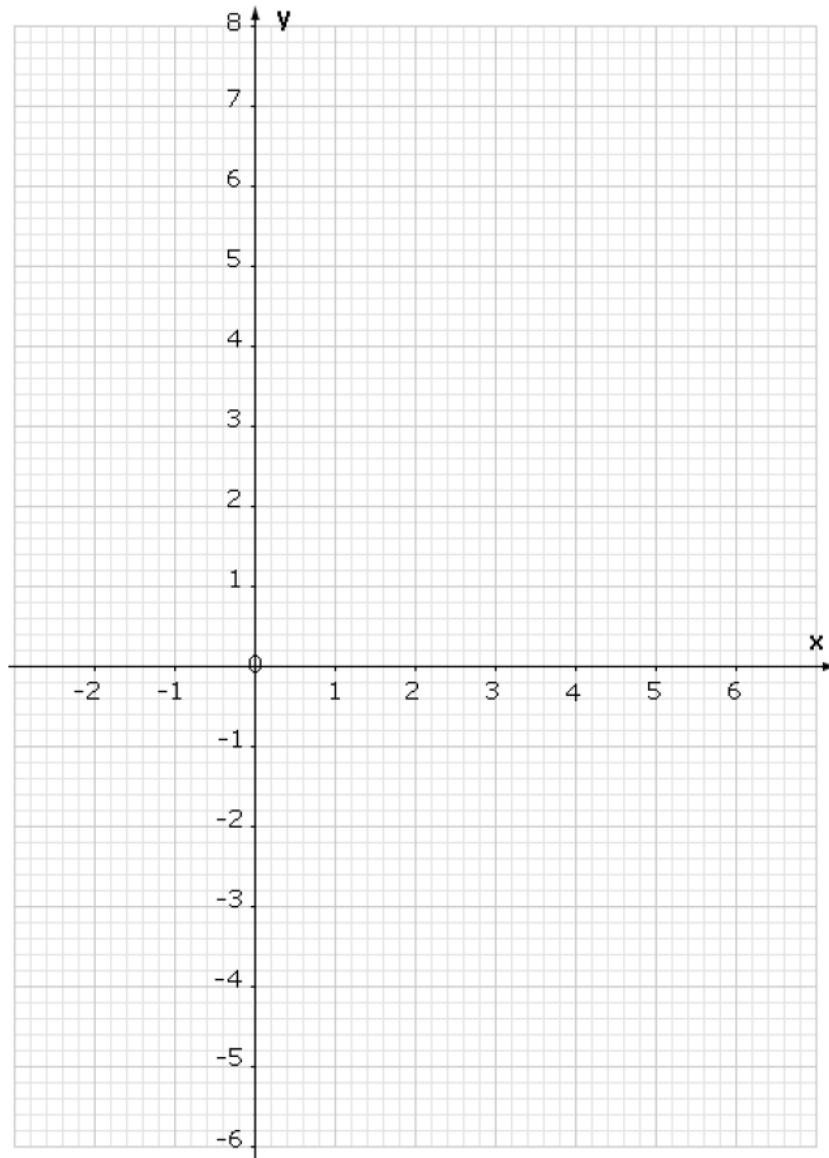


.....° (4 marks)

15. (a) Fill in the following table for the function: $y = x^2 - 3x - 3$ (3 marks)

x	-2	-1	0	1	2	3	4	5
y								

- (b) Plot the graph (2 marks)



- (c) Find approximate solutions to $x^2 - 3x - 3 = 0$
 (3 marks)

- (d) Find approximate solutions to $x^2 - 3x - 3 = 3$
 (3 marks)

16. The table shows the probabilities of different weather, and the probability that an ice-cream stall will make a profit on any given day.

(a) Given that all of the possibilities are shown, complete the table.

Ice-cream stall		Weather	
Profit	0.78	Sunny	0.32
Break even	0.07	Dull	
Loss		Raining	0.18

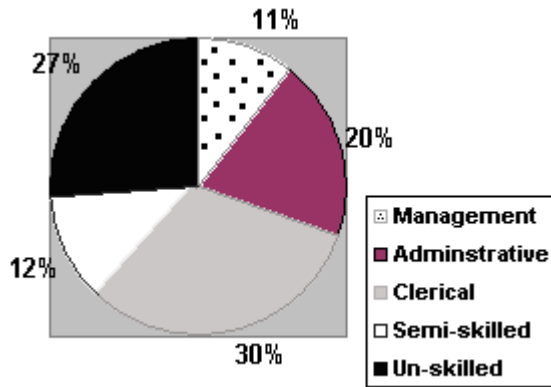
(2 marks)

(b) Would it be reasonable to calculate the probability that on a given day it was sunny and the ice-cream stall made a profit as 0.78×0.32 ? Justify your answer.

..... **(2 marks)**

17. The pie chart shows the distribution of types of job in a small town. In total, there are 12,000 workers.

A market research company is doing a survey on job satisfaction patterns and needs a stratified sample for 5% of the total.



- (a) Fill in the table showing how many workers in each category it should survey.

Management	
Administrative	
Clerical	
Semi-skilled	
Unskilled	

(4 marks)

- (b) Suggest one strategy the company can use to reduce the effect of bias in its survey.

..... **(1 mark)**

18. (a) Simplify the expression $\frac{3x+1}{x} + \frac{2x-1}{3}$

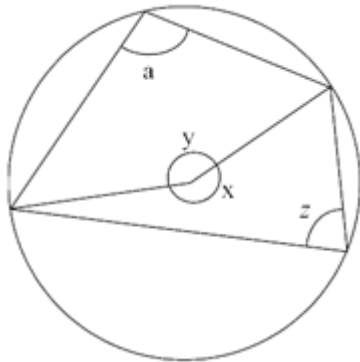
..... (2 marks)

b) Solve the equation $\frac{3x+1}{x} + \frac{2x-1}{3} = -3$

Give your answer to two decimal places.

..... (3 marks)

19. Express the angle x in terms of a.



Answer..... (1 mark)

Hence or otherwise, prove that the opposite angles in a cyclic quadrilateral add up to 180° .

..... (3 marks)

20. A computer games retailer sells packs of games made up from mid-price and full-price titles.

Pack A contains 3 mid-price and 2 full-price titles, and sells for £93.45.

Pack B contains 5 mid-price and 3 full-price titles, and sells for £146.42.

Assuming that the retailer has not applied any quantity discount, calculate the value of (a) one mid and (b) one full price game.

(a) Mid-price game: £

(b) Full-price game: £.....

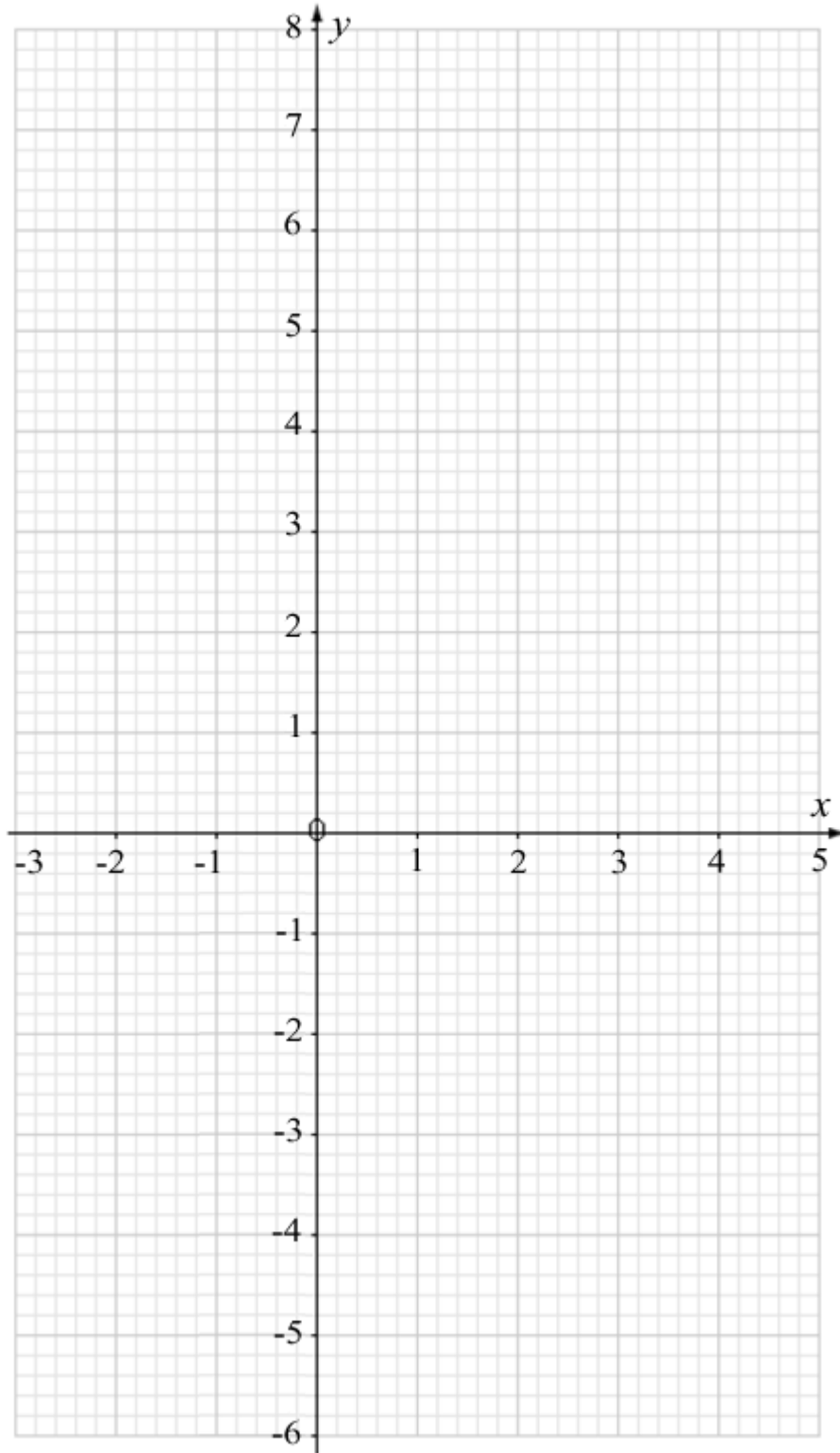
(4 marks)

21. Plot the graph of the following inequalities.
Shade the region which satisfies all three.

$$y \leq 3x + 2$$

$$y > 3$$

$$y \leq 7 - 2x$$



(5 marks)

22. A biologist is conducting an experiment to test for a relationship between the surface area of the leaves of a species of plant and the length of the leaf stem. She has found that the two are related with an inverse square proportionality. Leaf A has an area of 6.7cm^2 and a stem length of 2.3cm .

(a) Find a formula linking area and stem length. (Write the constant to 3 significant figures)

.....

(3 marks)

(b) Leaf B has an area of 5.2cm^2 . Calculate its stem length to 3 significant figures.

Answer:.....

(3 marks)

23. This table shows the height of children at a school:

Height (h cm)	Frequency
$130 < h \leq 140$	40
$140 < h \leq 150$	60
$150 < h \leq 160$	180
$160 < h \leq 170$	200
$170 < h \leq 180$	90
$180 < h \leq 190$	30

(a) How many children are there in the school?

..... (1 mark)

(b) What is the modal class?

..... (1 mark)

(c) Which class contains the median?

..... (2 marks)

(d) Calculate an estimate of the mean height of the children in the school.

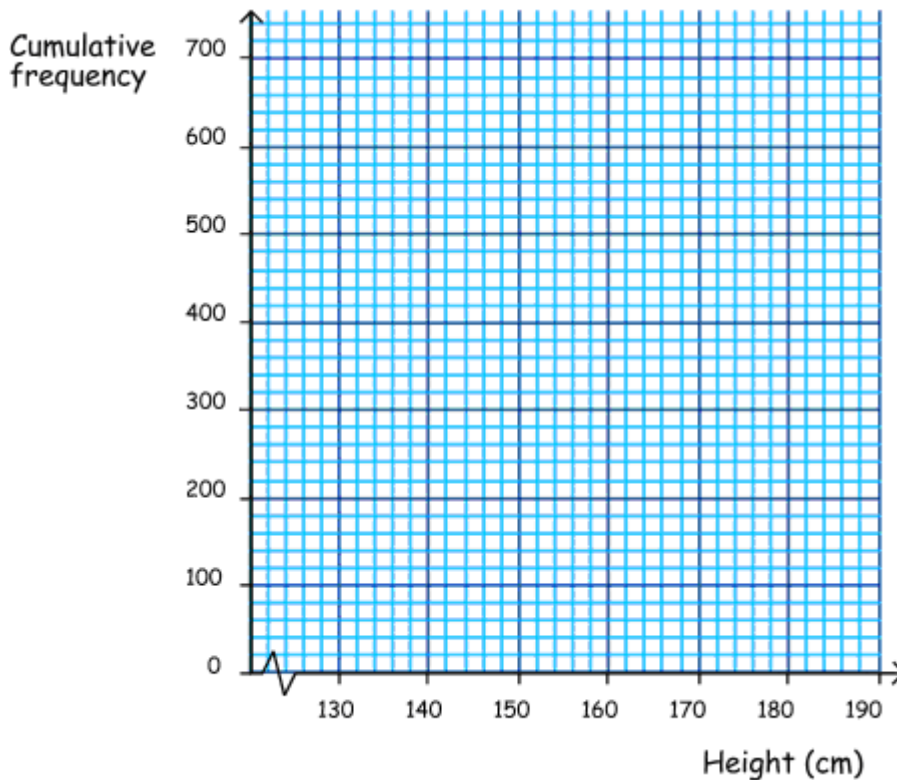
.....cm (3 marks)

(e) Complete the cumulative frequency chart:

Height (h cm)	Frequency	Cumulative frequency
$130 < h \leq 140$	40	40
$140 < h \leq 150$	60	100
$150 < h \leq 160$	180	
$160 < h \leq 170$	200	
$170 < h \leq 180$	90	
$180 < h \leq 190$	30	

(2 marks)

(f) Plot a cumulative frequency graph to represent this information.



(2 marks)

(g) Use your graph to estimate the number of pupils who are less than 166cm tall.

..... (1 mark)