GCSE MATHEMATICS

HIGHER PAPER

CALCULATOR

NO. 1

GCSE MATHEMATICS : HIGHER TIER (Calculator) – 2 Hours

Answer all 20 Questions. Show all working.

1. a) Rearrange this expression to make **p** the subject of the formula.

$$3\mathbf{q} = 4\mathbf{r} - 2\mathbf{p}$$

Answer: ……(2 marks)

b) Solve this expression for **y** .

$$\frac{4}{2 - \mathbf{y}} = \frac{3}{\mathbf{y} + 5}$$

Answer: ……(3 marks)

2. The solution to the equation $3\mathbf{x}^2 + 5\mathbf{x} = 17$ lies between 1 and 2. Find the value of **x** to 1 decimal place using the trial and improvement method.

Answer: ……(4 marks)

3. a) A bag of 27 sweets was shared out between three children in the ratio **4 : 3 : 2**
How many sweets were in the smallest share ?

Answer: ……...(3 marks)

b) The sweet manufacturer decides to sell the bags of sweets with 33⅓%
extra free. How many sweets will now be in a bag ?

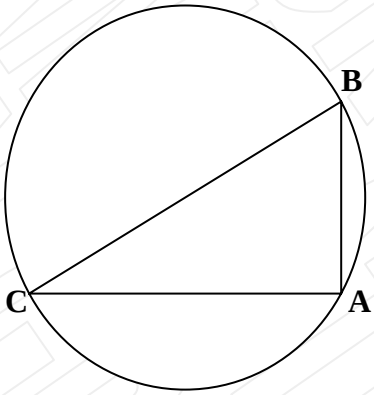
Answer: ……...(2 marks)

c) How many sweets are there in the largest share if the three children share out the new bag in the same ratio as in part a) ?

Answer: ……(2 marks)

4. The diagram below shows a triangle drawn within a circle, so that the three vertices of the triangle, **A**, **B** and **C** all lie on the circumference of the circle. Side **BC** of the triangle is a diameter of the circle, length 10cm. Side **AC** has length 8cm.

This is a sketch.
Not accurately drawn.



a) What is the size of angle **BAC** and why ?

Answer: ……
……
…….. (2 marks)

b) Calculate the length of side **AB**.

Answer: ……..…(2 marks)

c) Find the area of the circle, giving your answer correct to 3 significant figures.

Answer: …….(2 marks)

5. The table below shows information about the marks that 80 children scored in a History test, out of a maximum of 50 marks.

Marks, m	**Frequency, f**		
$0 < m \leq 10$	7		
$10 < m \leq 20$	18		
$20 < m \leq 30$	26		
$30 < m \leq 40$	20		
$40 < m \leq 50$	9		

a) Estimate the mean test mark, giving your answer to 1 decimal place.

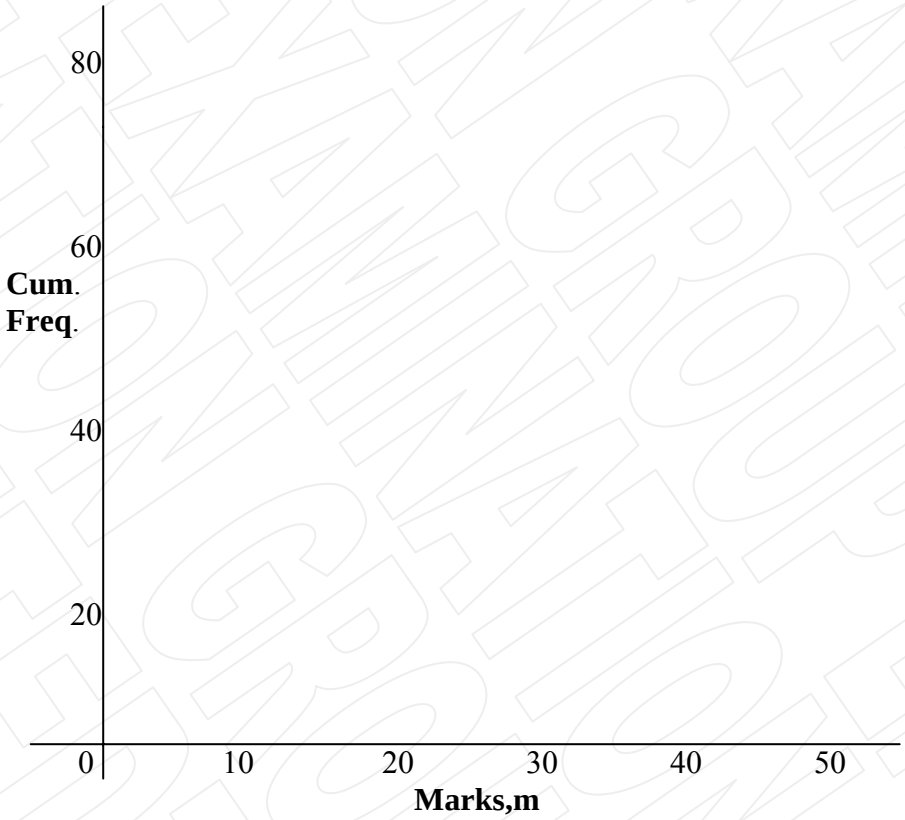
Answer: ..……..(4 marks)

b) Fill in the spaces in the cumulative frequency table below.

Marks, m	**Cumulative frequency**
$0 < m \leq 10$	
$10 < m \leq 20$	
$20 < m \leq 30$	
$30 < m \leq 40$	
$40 < m \leq 50$	

(1 mark)

c) On the grid overleaf, draw a cumulative frequency graph for the test marks.



(2 marks)

d) Using the graph, estimate the number of children scoring over 50% for the test.

Answer: ……(2 marks)

6. Simplify the following expressions.

a) $\mathbf{d}^3 \times \mathbf{d}^2$

Answer: ……(1 mark)

b) $4\mathbf{pq}^3 \times 2\mathbf{p}^2\mathbf{q}$

Answer: …….(2 marks)

c) $\dfrac{(3 - \mathbf{y})^2}{3 - \mathbf{y}}$

Answer: …….(1 mark)

d) Factorise the expression $\mathbf{x}^2 - 16\mathbf{y}^2$

Answer: ……..……(2 marks)

7. A lap-top computer is reduced in a sale by 15%, and is now priced at £510. What was the price before the sale?

Answer: …….(3 marks)

8. Solve the following pair of simultaneous equations for **x** and **y** .

$$2\mathbf{x} + 4\mathbf{y} = 6$$
$$\mathbf{x} - 3\mathbf{y} = 8$$

Answer: ……(4 marks)

9. Find the solution to $(6.1 \times 10^2) \times (2.8 \times 10^3)$ giving your answer in standard form correct to 2 decimal places.

Answer: ……(2 marks)

10. A town **P** is 17km due South of town **Q** and 8km due East of town **R**.

This is a sketch.
Not accurately drawn.

a) Find the size of angle **PQR**, correct to 3 significant figures.

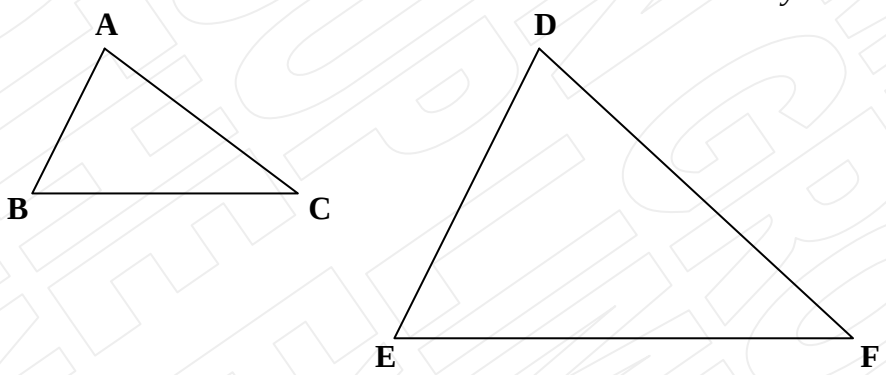
Answer:……..……..(3 marks)

b) Calculate the bearing of town **R** from town **Q**.

Answer: …….(1 mark)

11. Triangles **ABC** and **DEF** shown below are mathematically similar. Angle **ABC** = Angle **DEF** and Angle **BCA** = Angle **EFD**. Side lengths **AB** = 3cm, **BC** = 5cm, **DE** = 7.5cm and **DF** = 20 cm.

These are sketches.
Not accurately drawn.



a) Work out side length **EF**.

Answer: ……..(2 marks)

b) Work out side length **AC**.

Answer: ……..(2 marks)

12. a) If $\mathbf{x} = 61$ when $\mathbf{y} = 12.3$ then calculate the value of $\mathbf{z}$ correct to three significant figures if :

$$\frac{\mathbf{x}}{3\mathbf{y}} = \sqrt{\mathbf{x} - \mathbf{z}}$$

Answer: ……(3 marks)

b) Rearrange the formula :

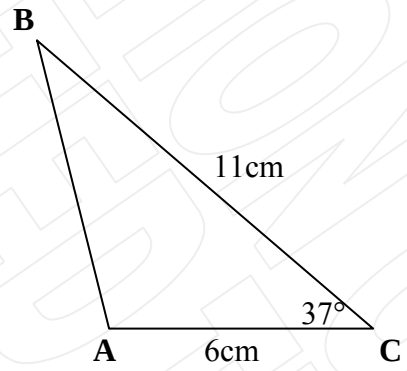
$$\frac{\mathbf{x}}{3\mathbf{y}} = \sqrt{\mathbf{x} - \mathbf{z}}$$

to make $\mathbf{x}$ the subject.

Answer: ……(3 marks)

13. Work out the area of triangle **ABC** shown below. Give your answer correct to 1 decimal place.

This is a sketch.
Not accurately drawn.



Answer: ……..(3 marks)

14. A new car cost £12995 in January 2005. Its value, £**V**, after **a** years can be calculated using this formula:

$$\mathbf{V} = 12995 \times (0.86)^{a}$$

a) What is the annual rate of depreciation of the car?

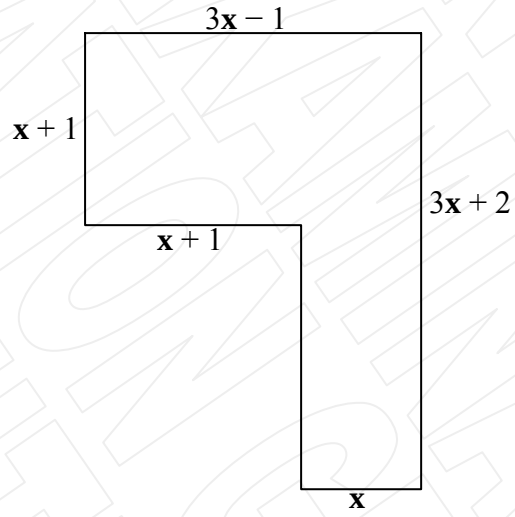
Answer: …….(1 mark)

b) Find the expected value of the car in January 2013.

Answer: …….(2 marks)

15. The internal angles of the shape shown below are all 90°. The Area of the shape is 49cm²

This is a sketch.
Not accurately drawn.



a) Prove that $\mathbf{x}^2 + \mathbf{x} - 12 = 0$

(3 marks)

b) Solve the expression $\mathbf{x}^2 + \mathbf{x} - 12 = 0$ for $\mathbf{x}$ (2 values), and hence find the length of the longest side of the shape.

Answer: ……(4 marks)

16. Two bags both contain seven raffle tickets. In bag A there are four black tickets, two green tickets and one white ticket. In bag B there are two black tickets, three green tickets and two white tickets.

a) If one ticket is picked from bag A and one ticket is picked from bag B, then what is the probability of both tickets being the same colour?

Answer: ……....(3 marks)

b) If it costs 50 pence to pick a pair of tickets (one from each bag), and you win £1 if you get two tickets of the same colour, then how much could you expect to win if you spent £17.50 on attempts.

Answer: ……..(2 marks)

17. The length of a 100 metre running track is accurate to the nearest metre. John runs this distance in 17.9 seconds, correct to 1 decimal place. Calculate the upper and lower bounds of Johns speed in Kilometres per Hour, giving your answer correct to three significant figures.

Answer: ……....(4 marks)

18. Simplify the following expressions.

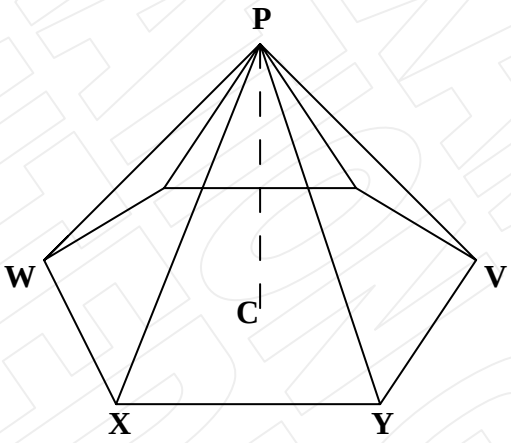
a) $(4\mathbf{p}^2\mathbf{q})^3$

Answer: ……....(2 marks)

b) $\dfrac{\mathbf{x}^2 - 7\mathbf{x}}{\mathbf{x}^2 - 5\mathbf{x} - 14}$

Answer: …….(3 marks)

19. A pyramid is shown below. The peak of the pyramid, **P** is a vertical height of 50 metres above the centre, **C** of the base. The base is a regular hexagon of side length 30 metres.



This is a sketch.
Not accurately drawn.

a) Calculate the distance between **P** and **V**, one of the vertices of the base. Give your answer correct to one decimal place.

Answer: ……(2 marks)

b) Calculate the size of the angle **VPW**. Give your answer correct to three significant figures.

Answer: ……(3 marks)

c) Calculate the size of angle **VPX**. Give your answer correct to three significant figures.

Answer: ……...(4 marks)

20. In the space below using just a ruler and compasses, **construct** angles of 60˚ and 90˚. Show all construction lines.

(4 marks)

END OF EXAMINATION : TOTAL 100 MARKS