

Write your name here

Surname

Other Names

Mathematics

Paper 1 (Non-Calculator) Higher Tier

Time: 1 hour 30 minutes

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – there may be more space than you need.
- **Calculators may not be used.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**



Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Higher Tier Formulae Sheet

Perimeter, area and volume

Where a and b are the lengths of the parallel sides and h is their perpendicular separation:

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

Volume of a prism = area of cross section \times length

Where r is the radius and d is the diameter:

$$\text{Circumference of a circle} = 2\pi r = \pi d$$

$$\text{Area of a circle} = \pi r^2$$

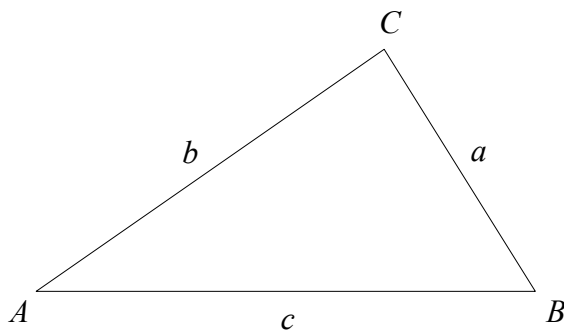
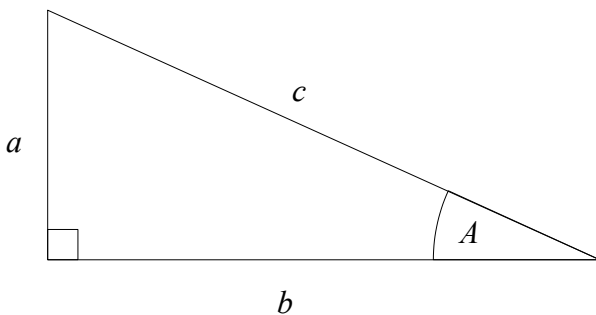
Quadratic formula

The solution of $ax^2 + bx + c = 0$

where $a \neq 0$

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

Pythagoras' Theorem and Trigonometry



In any right-angled triangle where a , b and c are the length of the sides and c is the hypotenuse:

$$a^2 + b^2 = c^2$$

In any right-angled triangle ABC where a , b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$

In any triangle ABC where a , b and c are the length of the sides:

$$\text{sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A$$

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

Compound Interest

Where P is the principal amount, r is the interest rate over a given period and n is number of times that the interest is compounded:

$$\text{Total accrued} = P \left(1 + \frac{r}{100} \right)^n$$

Probability

Where $P(A)$ is the probability of outcome A and $P(B)$ is the probability of outcome B :

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A \text{ given } B) P(B)$$

END OF EXAM AID

1 Work out $5.92 \div 0.16$

.....
(Total for Question 1 is 3 marks)

2 Write 324 as a product of powers of its prime factors.

.....
(Total for Question 2 is 3 marks)

3 (a) Work out $2\frac{2}{3} + 1\frac{3}{5}$

Give your answer as a mixed number.

.....
(2)

(b) Work out $\frac{2}{3} \div \frac{3}{4}$

.....
(2)

(Total for Question 3 is 4 marks)

4 Work out the value of $\frac{5^{-3} \times 5^7}{5}$

.....
(Total for Question 4 is 2 marks)

5 Tracey writes down three numbers a , b and c .

$$a : b = 3 : 5$$

$$a : c = 4 : 7$$

(a) Find $a : b : c$

.....
(2)

Jamie writes down three numbers d , e and f .

$$d = 2e$$

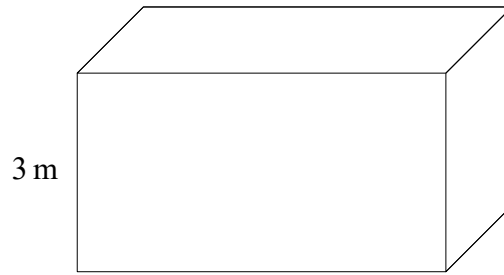
$$f = 3d$$

(b) Find $e : d : f$

.....
(2)

(Total for Question 5 is 4 marks)

6 The diagram shows a cuboid.



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The cuboid has height 3 m

The volume of the cuboid is 21 m^3

The pressure on the floor due to the cuboid is 25 newtons/m^2

Work out the force exerted by the cuboid on the floor.

..... newtons

(Total for Question 6 is 3 marks)

7 In a bag there are counters.

The counters are all either red or blue or yellow.

The number of red counters : The number of blue counters : The number of yellow counters = 4 : 5 : 8

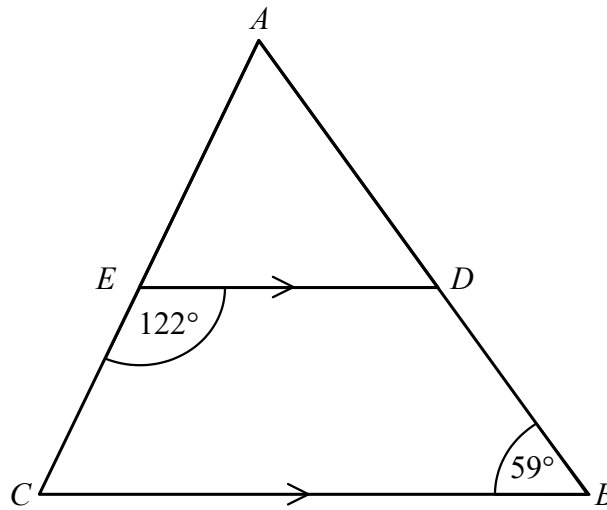
The number of yellow counters is 24 more than the numbers of blue counters.

Work out the total number of counters in the bag.

.....

(Total for Question 7 is 3 marks)

8 ABC is a triangle.



AEC and ADB are straight lines.

ED is parallel to CB .

Angle $CED = 122^\circ$

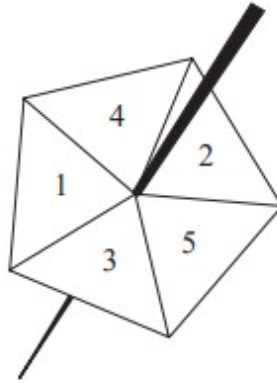
Angle $ABC = 59^\circ$

Work out the size of angle CAB .

You must give a reason for each stage of your working.

(Total for Question 8 is 5 marks)

9 Roy spins a biased 5-sided spinner 48 times.



Here are his results.

Score	1	2	3	4	5
Frequency	9	10	6	7	16

Roy is now going to spin the spinner another two times.

Work out an estimate for the probability that he gets a score of 5 both times

.....
(Total for Question 9 is 2 marks)

10 Solve the simultaneous equations

$$\begin{aligned}2x - y &= 4 \\5x + 2y &= 7\end{aligned}$$

$x =$

$y =$

(Total for Question 10 is 4 marks)

11 Work out the value of $8^{\frac{4}{3}} + \left(\frac{1}{3}\right)^{-3}$

(Total for Question 11 is 3 marks)

12 There are p counters in a bag.
60 of the counters are white.

Jill takes at random 50 counters from the bag.
8 of these 50 counters are white.

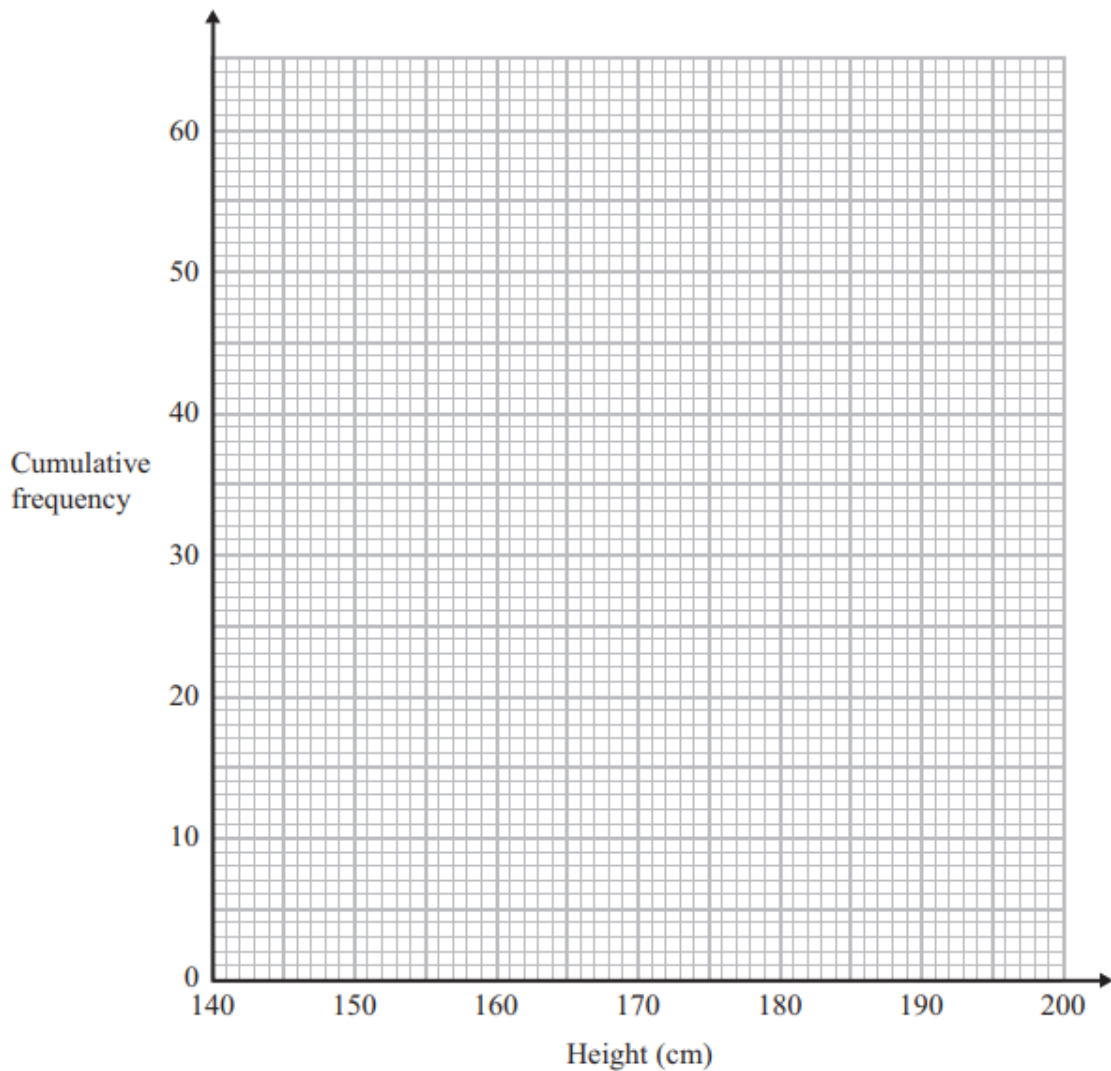
Work out an estimate for the value of p .

(Total for Question 12 is 2 marks)

13 The cumulative frequency table shows the height, in cm, of some tomato plants.

Height	Cumulative Frequency
$140 < h \leq 150$	7
$140 < h \leq 160$	17
$140 < h \leq 170$	32
$140 < h \leq 180$	51
$140 < h \leq 190$	57
$140 < h \leq 200$	60

(a) On the grid, plot a cumulative frequency graph for this information.



(2)

(b) Use the graph to find an estimate for the median height of the plants.

..... cm
(1)

(Total for Question 13 is 3 marks)

14 x is inversely proportional to y

Complete the table of values.

x	80	16		4
y	2		32	

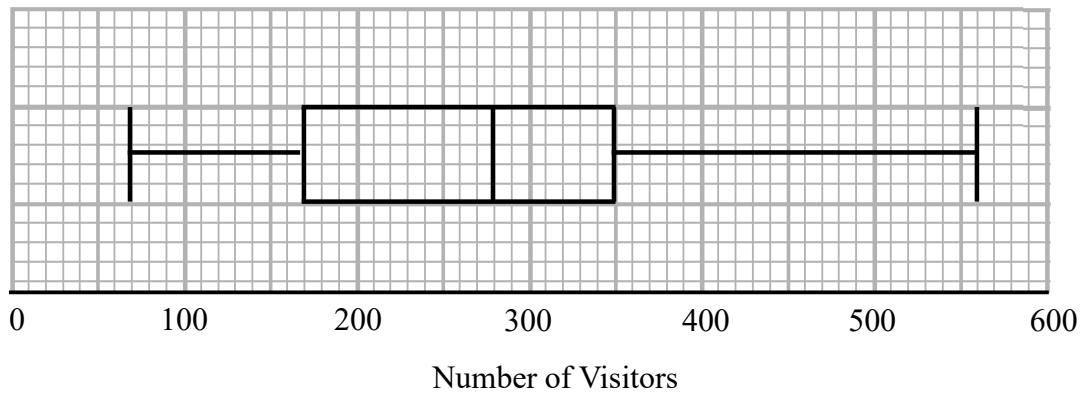
(Total for Question 14 is 3 marks)

15 The straight line **L** has equation $2y + 3x - 9 = 0$

Find an equation of the straight line perpendicular to **L** that passes through $(3, -7)$

(Total for Question 15 is 3 marks)

16 The box plot shows the number of visitors to a park on each of 180 days.



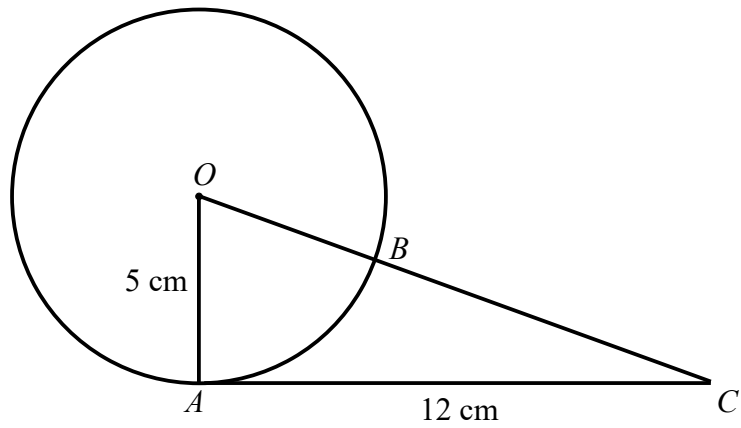
Work out an estimate for the number of days there were fewer than 350 visitors to the park.

.....
(Total for Question 16 is 2 marks)

17 Prove that the difference between the squares of two consecutive odd numbers is a multiple of 8.

.....
(Total for Question 17 is 4 marks)

18



A and B are points on the circumference of a circle, centre O .
 AC is a tangent to the circle.
 OBC is a straight line.

$OA = 5$ cm
 $AC = 12$ cm

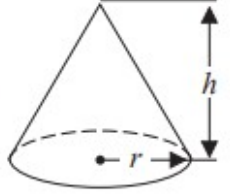
Find the length of BC .
You must show all your working.

..... cm

(Total for Question 18 is 4 marks)

19 A cone has height 12 cm and volume $72\pi \text{ cm}^3$.

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



The diagram shows a cone with a circular base. A horizontal line from the center of the base to the edge is labeled 'r'. A vertical line from the apex to the center of the base is labeled 'h'. The base is represented by a dashed line to indicate it is behind the cone.

Find the diameter of the cone.

Give your answer in the form $a\sqrt{b}$ where a is an integer and b is a prime number.

..... cm

(Total for Question 19 is 4 marks)

20 A, B and C are three points such that

$$\vec{AB} = 6\mathbf{a} + 9\mathbf{b}$$

$$\vec{AC} = 10\mathbf{a} + 15\mathbf{b}$$

(a) Prove that A, B and C lie on a straight line.

(2)

Three points D, E and F lie on a straight line such that

$$\vec{DE} = 4\mathbf{a} - 5\mathbf{b}$$

$$\vec{EF} = -12\mathbf{a} + 15\mathbf{b}$$

Find the ratio

length of DF : length of DE

.....
(3)

(Total for Question 20 is 5 marks)

21 The functions f and g are such that

$$f(x) = 3x^2 + 1 \text{ for } x > 0 \quad \text{and} \quad g(x) = 2x - 3$$

(a) Find $f^{-1}(x)$

(b) Solve $gf(x) = 95$

.....
(2)

.....
(3)

(Total for Question 21 is 5 marks)

22 Write $\frac{\sqrt{8}}{3 - \sqrt{2}}$ in the form $\frac{a\sqrt{2} + b}{c}$ where a , b and c are integers.

.....

(Total for Question 22 is 4 marks)

23 Find the set of values of x for which

$$25 - x^2 > 0 \quad \text{and} \quad 3x^2 - 17x - 6 < 0$$

You must show all your working.

.....
(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS