GCSE MATHEMATICS

S21-C300

With Calculator Assessment Resource R

Higher Tier

Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

Curved surface area of a cone = πrl

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

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

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

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

1. Rashid plays a game.
Each time he can score 1 point, 5 points or 10 points.
The table shows the probability of each outcome.

Points	Probability
1	0·80
5	0·15
10	0·05

Rashid plays the game 40 times.

How many times does he expect to score more than 1 point? [3]

$P(P > 1) = 0.20$ $0.05 + 0.15 = 0.2$

↳ at one time

$40 \times 0.2 =$ 8 times

↳ in total

2. *ABCD* is a parallelogram.

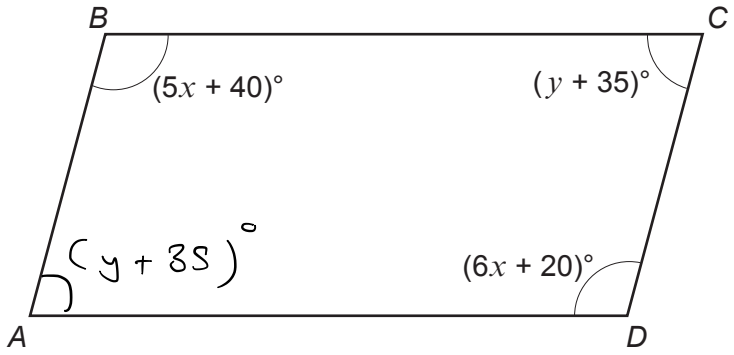


Diagram not drawn to scale

Work out the value of x and the value of y.
You must show all your working. [5]

$5x + 40 = 6x + 20$

$20 = x$

$y + 35 + 6x + 20 = 180$

$y + 35 + 6 \times 20 + 20 = 180$

$175 + y = 180$

$y = 5$

$x =$ 20° $y =$ 5°

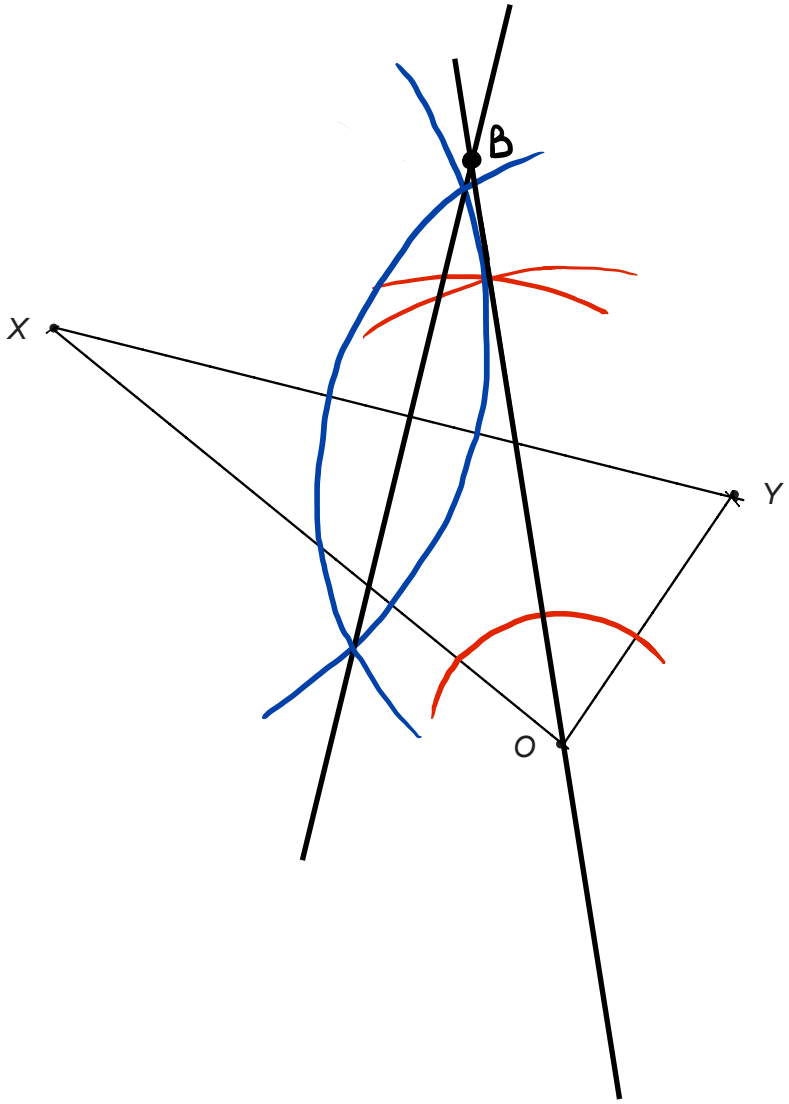
3. Cheng stands at *O* and rolls a ball along the horizontal ground.

The ball stops at point *B*, which:

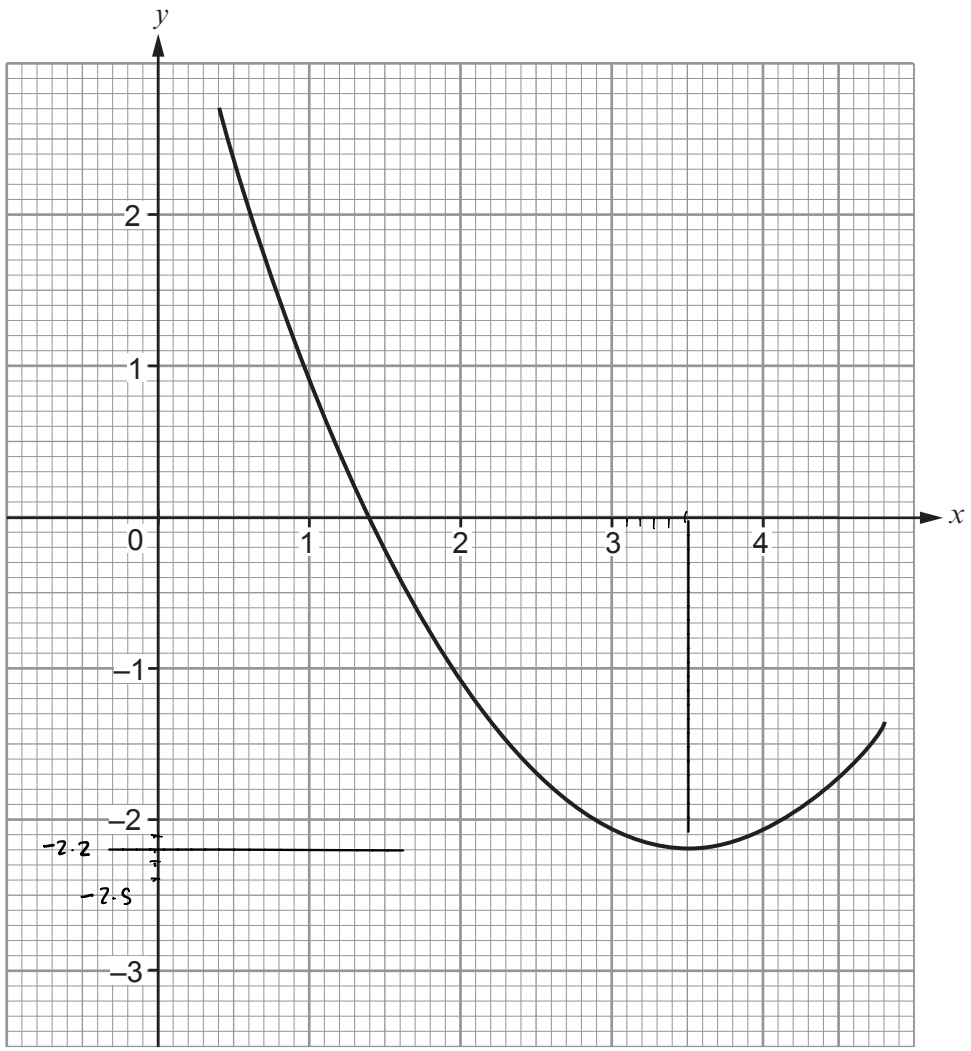
- is equidistant from *X* and *Y*,
- lies on the bisector of angle *XOY*.

Use a ruler and a pair of compasses to **construct** suitable lines and arcs to show the position of point *B*.

Construction arcs must be clearly shown. [5]



4. The graph shows part of a quadratic curve.



(a) Use the graph to write down the minimum value of y. [1]

-2.2 = min value of y

(b) The curve cuts the x-axis at (1·4, 0) and (a, 0).

Calculate the value of a. [2]

$3.5 - 1.4 = 2.1$

$3.5 + 2.1 = 5.6$

$a = 5.6$

5. n is a positive integer.

Prove that, for all possible values of n, $(2n-1)^2$ is an odd number. [2]

$(2n-1)^2$

$(2n-1)(2n-1)$

$= 4n^2 - 2n - 2n + 1$

$= 4n^2 - 4n + 1$ 4 x anything is even

$= 4n(n-1) + 1$

= even number + 1

= odd number

6. The mean of the data in the frequency table below is 2·7.

x	Frequency	fx
1	a	a
2	5	10
3	1	3
4	b	$4b$
5	2	10
6	3	18
Total	30	$11 + 4b + a$

Work out the values of a and b.
You must show all your working. [5]

mean = 2·7

$\frac{11 + 4b + a}{30} = 2.7$

$11 + 4b + a = 81$

(2) $4b + a = 40$

$19 = a + 7$

$a = 12$

$30 = 11 + a + b$

$19 = a + b$ (1)

$19 - b = a$

(3) = $a + 4b = 40$

$-a + b = 19$

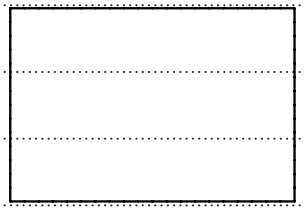
$3b = 21$

$b = 7$

7. A rectangle has:

- length y cm,
- perimeter 30 cm,
- area 55 cm^2.

(a) Form an equation in y and show that it can be simplified to $y^2 - 15y + 55 = 0$. [3]



Perimeter = $30 = 2y + 2x$

$30 - 2y = 2x$

$15 - y = x$

Area $yx = 55$

$x = \frac{55}{y}$

$15 - y = \frac{55}{y}$

$15y - y^2 = 55$

$y^2 - 15y + 55 = 0$

(b) (i) Use the quadratic formula to solve the equation given in part *(a)*.
Give your answers correct to 2 decimal places.
You must show all your working. [3]

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

$\frac{+15 + \sqrt{15^2 - 4(55)}}{2(1)}$ $\quad$ $\frac{+15 - \sqrt{15^2 - 4(55)}}{2(1)}$

$= \frac{15 + \sqrt{5}}{2} = 8.618$ $\quad$ $= \frac{15 - \sqrt{5}}{2} = 6.38...$

≈ 8.6 (2dp) $\quad$ ≈ 6.4 (2dp)

(ii) Interpret your answers in terms of the rectangle. [1]

y : 6.4 OR 8.6

The two side of rectangle have the length of 6.4 and 8.6.

8. *(a)* Show that $x = \sqrt{x+7}$ is a rearrangement of $x^2 - x - 7 = 0$. [1]

$x = \sqrt{x+7}$

$\rightarrow x^2 = x + 7$

$\rightarrow x^2 - x - 7 = 0$

(b) Use the iteration formula

$$x_{n+1} = \sqrt{x_n + 7} \text{ starting with } x_1 = 3$$

to find a solution of $x^2 - x - 7 = 0$. Give your answer correct to 2 decimal places.

You must give all your calculated values of x_{n+1}. [3]

$x_1 = 3$

$x_2 = \sqrt{3+7} = \sqrt{10}$

$x_3 = \sqrt{\sqrt{10}+7} = 3.1878\ldots$

$x_4 = 3.19183846$

$x_5 = 3.19245589$

$x_6 = 3.19256156$

$x_7 = 3.19257954$

Solution of $x^2 - x - 7 = 0$ to 2dp is $x = 3.19$

9. The diagram shows a sector of a circle with radius r cm and angle $x°$.

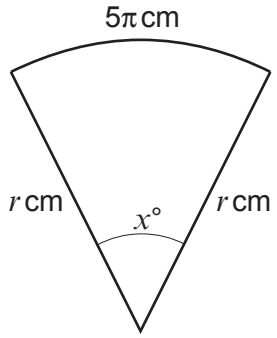


Diagram not drawn to scale

The arc length of the sector is 5π cm.

(a) Show that $x = \frac{900}{r}$. [2]

$5\pi = 2\pi r \times \frac{x}{360}$

$\frac{5}{2} = r \times \frac{x}{360} \rightarrow 900 = rx$

$\frac{900}{r} = x$ as required

(b) The area of the sector is 30π cm^2.

Calculate the value of x. [4]

$A = \frac{\theta}{360} \pi r^2 \rightarrow 30\pi = \frac{\frac{900}{r}}{360} \pi r^2$

$10800 = 900r$

$10800 = 900r$

$12 = r$

$\therefore x = \frac{900}{12} = 75°$