## [C056/SQP105]

Intermediate 2Time: 1 hour 30 minutesNATIONALMathematicsQUALIFICATIONSSpecimen Question Paper 2 (Units 1, 2, 3)Augustion Paper 2 (Units 1, 2, 3)

- 1 Answer as many questions as you can.
- 2 Full credit will be given only where the solution contains appropriate working.
- 3 You may use a calculator.
- 4 Square-ruled paper is provided.



## FORMULAE LIST

The roots of 
$$ax^2 + bx + c = 0$$
 are  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ 

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

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

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

- Volume of a sphere: Volume =  $\frac{4}{3}\pi r^3$
- Volume of a cone: Volume =  $\frac{1}{3}\pi r^2 h$
- Volume of a cylinder: Volume =  $\pi r^2 h$

Standard deviation:

$$s = \sqrt{\frac{\sum (x - \overline{x})^2}{n - 1}}$$



2. A storage barn is prism shaped, as shown below.



The cross-section of the storage barn consists of a rectangle measuring 7 metres by 5 metres and a semi-circle of radius 3.5 metres.

- (a) Find the volume of the storage barn.Give your answer in cubic metres, correct to 2 significant figures. (4)
- (b) An extension to the barn is planned to increase the volume by 200 cubic metres.



The uniform cross-section of the extension consists of a rectangle and a right-angled triangle.

Find the width of the extension.

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(3)

**3.** Two parachutists, X and Y, jump from two separate aircrafts at different times.

The graph shows how their height above the ground changes over a period of time.



- (a) Which parachutist jumped first?
- (b) Which parachutist did not open his parachute immediately after jumping?

Explain your answer clearly.

(3)

4. Figure 1 shows the circular cross-section of a tunnel with a horizontal floor.



In figure 2, AB represents the floor. AB is 2.4 metres. The radius, OA, of the cross-section is 2.5 metres. Find the height of the tunnel.



(4)

**5.** The table shows the emission levels of harmful gases at different places in a city.



Health regulations state that the emission levels of harmful gases should be **less** than 135 units.

The city council plan to reduce the levels in such a way that for each of the next 3 years the emission levels will be 5% less than the level in the previous year.

Will all the places listed in the table meet the health regulations in 3 years time?

Show clearly all your working.

(4)

**6.** Solve the equation

$$x^2 + 2x - 6 = 0$$

giving your answers correct to 1 decimal place.

(4)

7. The table shows the distribution of absentees per class on a particular day in a secondary school.

Number of absentees	Frequency
0	2
1	5
2	7
3	4
4	4
5	2
6	1

- (a) Make a cumulative frequency table from the above data. (1)
- (b) Find the median and the lower and upper quartiles for this distribution. (3)
- 8. The boat on a carnival ride travels along an arc of a circle, centre C.



The boat is attached to C by a rod 6 metres long.

The rod swings from position CA to position CB.

The length of the arc AB is 7 metres.

Find the angle through which the rod swings from position A to position B. (4)

**9.** Change the subject of the formula to *k* 

$$d = \frac{k - m}{t}.$$
 (2)

**10.** The diagram shows two positions of a student as she views the top of a tower.



From position B, the angle of elevation to T at the top of the tower is  $64^{\circ}$ . From position A, the angle of elevation to T at the top of the tower is  $69^{\circ}$ . The distance AB is 4.8 metres and the height of the student to eye level is 1.5 metres.

Find the height of the tower.

(6)

$$7\cos x^{\circ} - 2 = 0$$
, for  $0 \le x < 360$ . (3)

(b) Show that 
$$\frac{\sin^2 x}{1-\sin^2 x} = \tan^2 x.$$
 (2)

**12.** A rectangular sheet of plastic 18 cm by 100 cm is used to make a gutter for draining rain water.

The gutter is made by bending the sheet of plastic as shown below in diagram 1.



diagram 1

(a) The depth of the gutter is x centimetres as shown in diagram 2 below.Write down an expression in x for the width of the gutter. (1)



(b) Show that the volume, V cubic centimetres, of this gutter is given by

$$V = 1800x - 200x^2.$$
 (2)

(c) Find the dimensions of the gutter which has the largest volume.Show clearly all your working. (4)