

ELGIN ACADEMY

Prelim Examination 2006 / 07

<p>MATHEMATICS National Qualifications - Intermediate 2 Maths 1, 2 and 3 Paper 2</p>
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Time allowed - 1 hour 30 minutes

Read carefully

- 1. Calculators may be used in this paper.**
- 2. Full credit will be given only where the solution contains appropriate working.**
- 3. 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: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

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

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

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

Volume of a cylinder: $\text{Volume} = \pi r^2 h$

Standard deviation: $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n - 1}}$, where n is the sample size.

1. Bath bombs are in the shape of a sphere and have diameter 7cm.

In parts (a) and (b) of this question give your answers to the nearest cm^3 .



- (a) Calculate the volume of one bath bomb. [3]

- (b) When these bombs are dropped into a bath they lose 20% of their volume every minute.

Calculate what volume of the bath bomb remains after it has been in the bath for 3 minutes. [3]

- (c) Assuming that bath bomb remains spherical as it loses volume, calculate the radius of it after the 3 minutes. [3]

2. The ages of 20 members of the Stagestruck Drama Club are shown in this table:

31	20	28	32	18	22	32	28	15	21
38	36	24	21	23	13	30	17	42	43

- (a) Construct an ordered stem and leaf diagram for this data. [3]

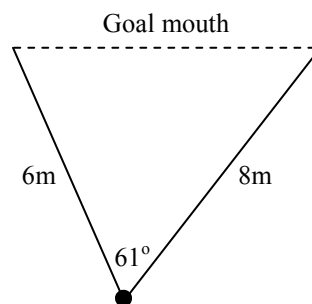
- (b) Hence, or otherwise, find the lower quartile, median and upper quartile for the data. [3]

3. A ball is placed in front of a set of goal posts.



The direct path to one post is 6m and to the other post is 8m.

The angle between the paths is 61° .



Calculate the width of the goal mouth giving your answer correct to **three significant figures**.

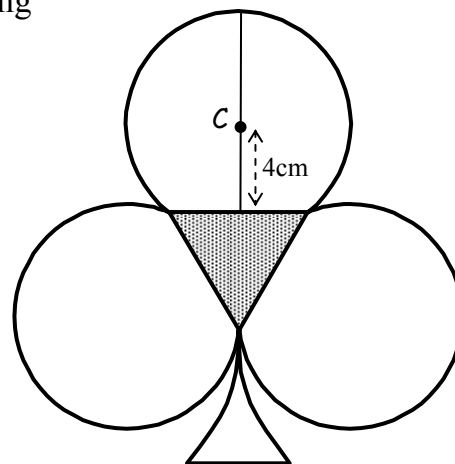
[4]

4. Solve the quadratic equation $2x^2 + 7x - 3 = 0$ giving your answers **correct to 1 decimal place**.

[4]

5. A logo for a Bridge Playing Club is based on 3 intersecting circles with an equilateral triangle in the centre.

The radius of each circle is 5 cm and the distance from the midpoint of a side of the triangle to the centre of a circle is 4 cm.



- (a) Calculate the length of a side of the triangle.

[4]

- (b) Calculate the area of this triangle.

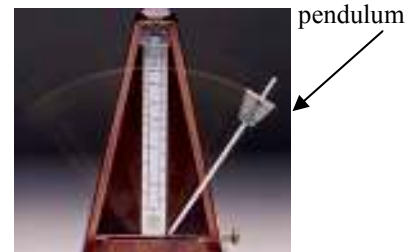
[3]

6. Change the subject of the formula

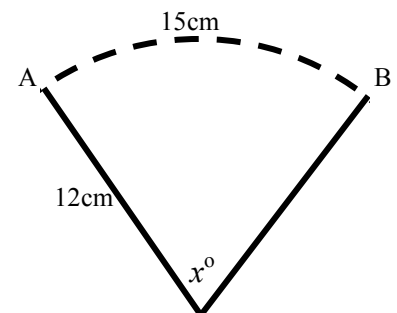
$$A = \frac{1}{2}ab \sin C \quad \text{to } b \quad [2]$$

7. A metronome is a music tool which helps players with rhythm and tempo.

A weight on the pendulum is adjusted so that the metronome swings back and forth to give the correct tempo for a piece of music.



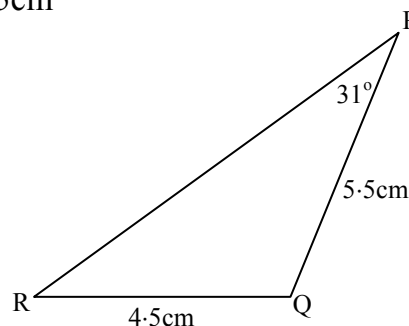
For one particular piece the pendulum is set to a length of 12cm and as it swings it traces out an arc of a circle, AB, of length 15cm.



Calculate, **to the nearest degree**, the angle, x° , through which the pendulum swings.

[3]

8. In triangle PQR, PQ is 5.5cm, RQ is 4.5cm and angle QPR is 31° .



Calculate the size of angle PQR.

[5]

9. On testing a new type of battery, the following data was produced for the time (in hours) before the battery needs replacing.

48 56 53 72 81 59

For this sample data, calculate:

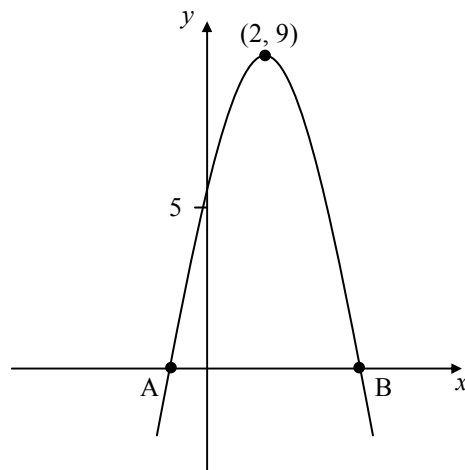
- a) the mean; [1]
b) the standard deviation. [3]

Show clearly all your working.

10. A well-known fast food restaurant uses two identical parabolas as part of its logo.

One of the parabolas is shown in the diagram below.

It has equation of the form $y = k(x - a)^2 + b$, where (a, b) is the turning point.



- (a) Given that the maximum turning point is $(2, 9)$, find the equation of this parabola, stating clearly the value of k . [3]
(b) Write down the equation of the axis of symmetry of the parabola. [1]
(c) The parabola cuts the x -axis at points A and B. If A is the point $(-1, 0)$, find the coordinates of the point B. [2]

END OF QUESTION PAPER