SOLUTIONS – PAPER 2 CALCULATOR

1. A car was bought for £24000.

The value of the car depreciated at a rate of 8.5% every year.

Calculate the value of the car after 4 years. 3

Multiplier $= 100\% - 8.5\% = 91.5\%$

$= 0.915$

New Value $= 0.915^4 \times 24000$

$= 16822.696...$

$= £16822.70$

2. Radio signals travel at a speed of approximately 3×10^8 metres per second.

A radio signal from Earth to a space probe takes 1.5 seconds.

Calculate the distance (in metres) from Earth to the space probe.

Give your answer in scientific notation. 3

$D = S \times T$

$= 3 \times 10^8 \times 1.5$

$= 4.5 \times 10^8$ metres

3. The results (in metres) of the top six athletes in the Women's long jump final at the 2004 Olympic Games in Athens are shown below.

7.07	7.05	7.05	6.96	6.85	6.83

(a) Calculate (correct to 2 decimal places) the mean and standard deviation of these distances. 4

$\bar{x} = \frac{7.07 + 7.05 + 7.05 + 6.96 + 6.85 + 6.83}{6}$

Mean = 6.97 m (to 2 dp)

x	$x - \bar{x}$	$(x - \bar{x})^2$
7.07	0.1	0.01
7.05	0.08	0.0064
7.05	0.08	0.0064
6.96	−0.01	0.0001
6.85	−0.12	0.0144
6.83	−0.14	0.0196

$\Sigma (x - \bar{x})^2 = 0.0569$

$n = 6$

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

$= \sqrt{\frac{0.0569}{6 - 1}}$

$= 0.11$ (to 2 dp)

In the 2016 Olympic Games in Rio, the mean distance for the top six athletes in the Women's long jump final was 7.02 metres and the standard deviation was 0.14 metres.

(b) Make two valid comparisons between the athletes. 2

On average, the athletes jumped further in the 2016 Games as the mean distance is greater (7.02 > 6.97).

The distances jumped at the 2004 Games were more consistent, as the standard deviation is lower (0.11 < 0.14)

4. Solve algebraically $6(x+7)=5(4-x)$ 3

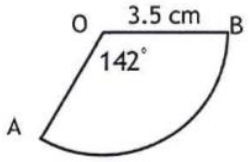
$6x + 42 = 20 - 5x$

$11x + 42 = 20$

$11x = -22$

$x = -2$

5. The sector AOB shown here has radius of 3.5 centimetres and a sector angle of 142°.



$d = 7\text{cm}$

Find the length of the arc AB.

3

Arc length $= \frac{\theta}{360} \times \pi d$

$= \frac{142}{360} \times \pi \times 7$

$= 8.674...$

$= 8.67\text{cm}$ (to 3 sig fig)

6. A shirt has been reduced in price by 40% to £27

Calculate the original price. 3

60% = £27

÷3 ↓ ↓ ÷3

20% = £9

×5 ↓ ↓ ×5

100% = £45

The original price was £45

7. Simplify $\frac{3x^2 \times 4x^6}{6x^2}$ 2

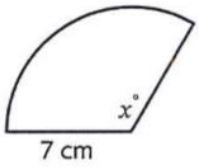
$= \frac{12x^{(2+6)}}{6x^2}$

$= \frac{12x^8}{6x^2}$

$= 2x^{(8-2)}$

$= 2x^6$

8. This sector has an area of 55.6 square centimetres and radius 7 centimetres.



Calculate the size of angle x°

Give your answer to the nearest degree. 4

$$\frac{\text{Angle}}{360} = \frac{\cancel{\text{Arc}}}{\cancel{\pi d}} = \frac{\text{Area}}{\pi r^2}$$

$$\frac{x}{360} = \frac{55.6}{\pi \times 7^2}$$

$$\frac{x}{360} = \frac{55.6}{49\pi}$$

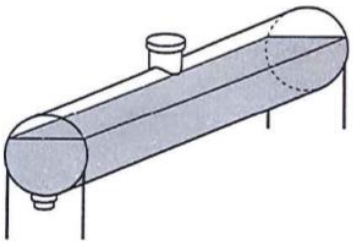
$$x = \frac{55.6 \times 360}{49\pi}$$

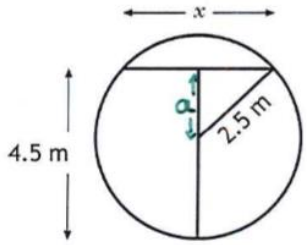
$$x = 130.02\ldots$$

$$x = 130^\circ \text{ (to nearest degree)}$$

10. An oil tank has a circular cross section of radius 2.5 metres.

The tank is filled to a depth of 4.5 metres.

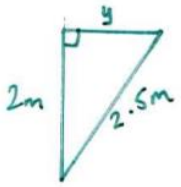




$a = 4.5 - 2.5$

$= 2m$

(a) Calculate x, the width (in metres) of the oil surface. 3



$y^2 = 2.5^2 - 2^2$

$= 6.25 - 4$

$= 2.25$

$y = \sqrt{2.25}$

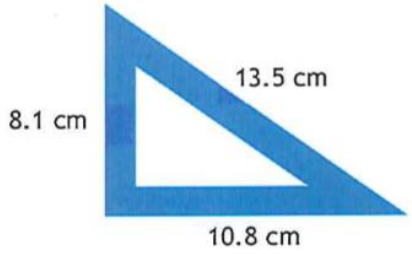
$= 1.5$

Width of surface (x) $= 1.5 \times 2$

$= 3m$

12. A company is producing a new size of set square which must have a perfect right angle at one of its corners.

The company produce a prototype with sides of length 8.1 cm, 10.8 cm and 13.5 cm.



Is this set square acceptable?

You must justify your answer. 3

$8.1^2 + 10.8^2 = 182.25$

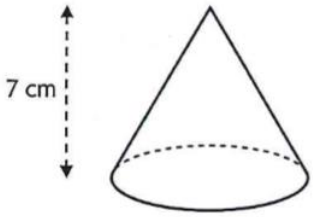
$13.5^2 = 182.25$

As $8.1^2 + 10.8^2 = 13.5^2$, by the Converse of Pythagoras, the triangle contains a right angle.

The set square is acceptable.

17. The cone shown has diameter 3 centimetres and vertical height 7 centimetres.

(a) Calculate the volume of this cone.



2

$r = 1.5\text{cm}$

$V_{cone} = \frac{1}{3}\pi r^2 h$

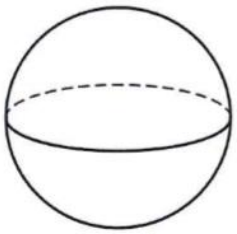
$= \frac{1}{3}\pi \times 1.5^2 \times 7$

$= 16.493...$

$= 16.5\text{cm}^3$ (3 sig fig)

The sphere shown here has volume 268.08 cubic centimetres.

(b) Find (to the nearest centimetre) the radius of this sphere.



$V_{sphere} = \frac{4}{3}\pi r^3$

$\frac{4}{3}\pi r^3 = V$

$4\pi r^3 = 3V$

$r^3 = \frac{3V}{4\pi}$

$r = \sqrt[3]{\frac{3V}{4\pi}}$

$r = \sqrt[3]{\frac{3 \times 268.08}{4\pi}}$

$r = 3.999\ldots$

$r = 4$ cm (to nearest cm)

3