Year 10 · Measurement: Sizing It Up: Shapes, Speed & Sig Figs

Name: _____ Date: _____

Kia ora! This sheet mixes together everything from significant figures and metric prefixes to circle areas, cylinders, Pythagoras and speed. Show your working, use one extra significant figure while you calculate, then round at the very end.

Warm-up

1. Convert 3.5 km into metres.

2. Round 47.386 to 3 significant figures.

3. Find the area of a circle with radius 5 cm, to 3 significant figures.

4. Convert 2500 mg into grams.

Practice

5. Find the surface area of a rectangular prism (a shoebox) measuring 8 cm × 5 cm × 3 cm.

6. A cylinder has radius 4 cm and height 10 cm. Find its volume to 3 significant figures.

7. Word problem: Aroha drives from Avondale to Hamilton, a distance of 90 km, in 1.5 hours. What is her average speed in km/h?

8. Word problem: A cylindrical rainwater tank has radius 0.6 m and height 1.2 m. Find its capacity in litres, to 3 significant figures. (1 m^3 = 1000 L.)

9. A right-angled triangle has legs of 6 cm and 8 cm. Use Pythagoras to find the length of the hypotenuse.

10. A window is made of a rectangle 10 cm wide and 6 cm tall, topped by a semicircle of radius 5 cm. Find the total area to 3 significant figures.

Challenge

11. A triangular prism has a right-angled triangular cross-section with legs 6 cm and 8 cm, and a length of 15 cm. Find (a) its volume, and (b) its total surface area.

12. A delivery drone flies in a straight line from point (2, 3) to point (10, 9) on a map grid where each unit represents 100 m. The trip takes 20 seconds. Find (a) the straight-line distance in metres, and (b) the drone's speed in km/h.

Answer key (for parents and tutors)

1. Convert 3.5 km into metres.
   1 km = 1000 m, so 3.5 km = 3.5 × 1000 = 3500 m.

2. Round 47.386 to 3 significant figures.
   The first three significant figures are 4, 7 and 3. The next digit is 8, so round up: 47.386 → 47.4.

3. Find the area of a circle with radius 5 cm, to 3 significant figures.
   $A = \pi r^2 = \pi \times 5^2 = \pi \times 25 = 78.539\ldots \approx 78.5\ \text{cm}^2$.

4. Convert 2500 mg into grams.
   milli– means one thousandth, so 1 g = 1000 mg. 2500 ÷ 1000 = 2.5 g.

5. Find the surface area of a rectangular prism (a shoebox) measuring 8 cm × 5 cm × 3 cm.
   $SA = 2(lw + lh + wh) = 2(8\times5 + 8\times3 + 5\times3) = 2(40 + 24 + 15) = 2 \times 79 = 158\ \text{cm}^2$.

6. A cylinder has radius 4 cm and height 10 cm. Find its volume to 3 significant figures.
   $V = \pi r^2 h = \pi \times 4^2 \times 10 = \pi \times 16 \times 10 = \pi \times 160 = 502.65\ldots \approx 503\ \text{cm}^3$.

7. Word problem: Aroha drives from Avondale to Hamilton, a distance of 90 km, in 1.5 hours. What is her average speed in km/h?
   speed = distance ÷ time = 90 ÷ 1.5 = 60 km/h.

8. Word problem: A cylindrical rainwater tank has radius 0.6 m and height 1.2 m. Find its capacity in litres, to 3 significant figures. (1 m^3 = 1000 L.)
   $V = \pi r^2 h = \pi \times 0.6^2 \times 1.2 = \pi \times 0.36 \times 1.2 = \pi \times 0.432 = 1.3572\ldots\ m^3$. Convert: 1.3572 × 1000 = 1357.2 L ≈ 1360 L.

9. A right-angled triangle has legs of 6 cm and 8 cm. Use Pythagoras to find the length of the hypotenuse.
   $c^2 = a^2 + b^2 = 6^2 + 8^2 = 36 + 64 = 100$, so $c = \sqrt{100} = 10$ cm. (This is the 3–4–5 triple scaled by 2.)

10. A window is made of a rectangle 10 cm wide and 6 cm tall, topped by a semicircle of radius 5 cm. Find the total area to 3 significant figures.
    Rectangle area = $10 \times 6 = 60\ \text{cm}^2$. Semicircle area = $\frac{1}{2}\pi r^2 = \frac{1}{2} \times \pi \times 5^2 = \frac{1}{2} \times \pi \times 25 = 39.269\ldots\ \text{cm}^2$. Total = 60 + 39.269 = 99.27 ≈ 99.3 cm^2.

11. A triangular prism has a right-angled triangular cross-section with legs 6 cm and 8 cm, and a length of 15 cm. Find (a) its volume, and (b) its total surface area.
    (a) Cross-sectional area $A = \frac{1}{2} \times 6 \times 8 = 24\ \text{cm}^2$. Volume $V = Al = 24 \times 15 = 360\ \text{cm}^3$. (b) The hypotenuse = $\sqrt{(6^2 + 8^2)} = \sqrt{100} = 10$ cm. The two triangular ends: $2 \times 24 = 48\ \text{cm}^2$. The three rectangular faces have total area = perimeter × length = $(6 + 8 + 10) \times 15 = 24 \times 15 = 360\ \text{cm}^2$. Total surface area = $48 + 360 = 408\ \text{cm}^2$.

12. A delivery drone flies in a straight line from point (2, 3) to point (10, 9) on a map grid where each unit represents 100 m. The trip takes 20 seconds. Find (a) the straight-line distance in metres, and (b) the drone's speed in km/h.
    (a) Using the distance formula: $d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]} = \sqrt{[(10 - 2)^2 + (9 - 3)^2]} = \sqrt{[8^2 + 6^2]} = \sqrt{(64 + 36)} = \sqrt{100} =$ 10 grid units. Each unit is 100 m, so distance = 10 × 100 = 1000 m. (b) speed = distance ÷ time = 1000 ÷ 20 = 50 m/s. Convert: 50 m/s × 3600 s = 180 000 m/h = 180 km/h.