📐 Year 9 QLD Mathematics: Measurement and Geometry Exercise Set

1. Measurement

1. Calculate the **volume** of a cylinder with a radius of 5 cm and a height of 10 cm. (Give your answer correct to one decimal place).
2. Find the **surface area** of a rectangular prism that is 8 m long, 3 m wide, and 2 m high.
3. A storage box is in the shape of a right prism with a triangular base. The base triangle has a base length of 6 cm and a height of 4 cm. The height of the prism is 12 cm. What is the **volume** of the prism?
4. A student measures the length of a desk to be 1.5 meters. The actual length is 1.48 meters. Calculate the **percentage error** in the measurement, correct to two decimal places.
5. Find the **total surface area** of a cylinder with a diameter of 10 mm and a height of 15 mm. (Give your answer in terms of π).

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2. Geometric Reasoning

1. Two triangles, $\triangle ABC$ and $\triangle XYZ$, are similar. If $AB = 4$ cm, $BC = 6$ cm, and $XY = 10$ cm, calculate the length of YZ.
2. In a diagram, two parallel lines are cut by a transversal. One **alternate interior angle** is 75°. What is the measure of the other alternate interior angle?
3. Given two vertically opposite angles, one is labelled $(3x - 10)^\circ$ and the other is 50°. Find the value of x.
4. $\triangle PQR$ is an isosceles triangle with $\angle PQR = 40^\circ$. $\angle PRQ$ and $\angle QPR$ are the base angles. Find the size of $\angle QPR$.
5. In the figure below, find the value of y, where y is an exterior angle of a triangle and the two opposite interior angles are 45° and 65°.

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3. Pythagoras' Theorem

1. A right-angled triangle has two shorter sides (legs) measuring 5 cm and 12 cm. Calculate the length of the **hypotenuse**.
2. The hypotenuse of a right-angled triangle is 17 m and one of the shorter sides is 8 m. Find the length of the unknown side.
3. Calculate the **distance** between the points $A(-1, 2)$ and $B(5, -6)$ on the Cartesian plane.
4. A ladder 10 m long leans against a wall. The base of the ladder is 6 m away from the wall. How high up the wall does the ladder reach?
5. A square has a side length of 7 cm. Calculate the length of the **diagonal** of the square, correct to two decimal places.

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4. Transformation

1. A triangle $A(1, 1)$, $B(3, 1)$, $C(2, 4)$ is enlarged by a scale factor of 3 from the origin $(0, 0)$. Write down the coordinates of the vertices of the image, A', B', and C'.
2. A point $P(5, -2)$ is reflected across the x-axis. What are the coordinates of the image P'?
3. A rectangle with vertices at $(0, 0)$, $(4, 0)$, $(4, 2)$, and $(0, 2)$ is enlarged by a scale factor of $\frac{1}{2}$ from the origin. What is the **area** of the image rectangle?
4. A transformation maps the point (x, y) to $(x - 3, y + 1)$. Describe this transformation.
5. A shape has an area of 25 cm^2. If it is enlarged by a scale factor of 4, what is the **area** of the enlarged shape?

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✅ Answers

1. Measurement

1. 785.4 cm^3 ($\text{Volume} = \pi r^2 h = \pi(5^2)(10) = 250\pi$)
2. 92 m^2 ($\text{Surface Area} = 2(lw + lh + wh) = 2(8 \cdot 3 + 8 \cdot 2 + 3 \cdot 2) = 2(24 + 16 + 6) = 2(46)$)
3. 144 cm^3 ($\text{Area of Base} = \frac{1}{2}bh = \frac{1}{2}(6)(4) = 12\text{ cm}^2$. $\text{Volume} = \text{Area of Base} \times \text{Height} = 12 \times 12$)

4. 1.35% (Error $= |1.5 - 1.48| = 0.02$ m. Percentage Error $= \frac{\text{Error}}{\text{Actual}} \times 100 = \frac{0.02}{1.48} \times 100 \approx 1.3513...$)
5. 200π mm^2 (Radius $r = 5$ mm. Surface Area $= 2\pi r^2 + 2\pi rh = 2\pi(5^2) + 2\pi(5)(15) = 50\pi + 150\pi$)

2. Geometric Reasoning

1. $YZ = 15$ cm (Scale factor $k = \frac{XY}{AB} = \frac{10}{4} = 2.5$. $YZ = BC \times k = 6 \times 2.5$)
2. 75° (**Alternate interior angles** are equal when lines are parallel.)
3. $x = 20$ (Vertically opposite angles are equal, so $3x - 10 = 50$. $3x = 60$)
4. 70° (Base angles of an isosceles triangle are equal. $\angle QPR = \frac{180^\circ - 40^\circ}{2}$)
5. $y = 110^\circ$ (
   The exterior angle of a triangle is equal to the sum of the two opposite interior angle
   . $y = 45^\circ + 65^\circ$)

3. Pythagoras' Theorem

1. 13 cm ($c^2 = 5^2 + 12^2 = 25 + 144 = 169$. $c = \sqrt{169}$)
2. 15 m ($a^2 = c^2 - b^2 = 17^2 - 8^2 = 289 - 64 = 225$. $a = \sqrt{225}$)
3. 10 units (Distance $= \sqrt{(5 - (-1))^2 + (-6 - 2)^2} = \sqrt{6^2 + (-8)^2} = \sqrt{36 + 64} = \sqrt{100}$)
4. 8 m (Height $= \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64}$)
5. 9.90 cm (Diagonal $d = \sqrt{7^2 + 7^2} = \sqrt{49 + 49} = \sqrt{98} \approx 9.899...$)

4. Transformation

1. $A'(3, 3)$, $B'(9, 3)$, $C'(6, 12)$ (Multiply each coordinate by the scale factor 3.)
2. $P'(5, 2)$ (The x-coordinate remains the same, and the y-coordinate is negated.)
3. 2 square units (Original area $= 4 \times 2 = 8$. New Area $=$ Original Area $\times$ (Scale Factor)$^2 = 8 \times (\frac{1}{2})^2 = 8 \times \frac{1}{4}$)
4. A **translation** (or slide) 3 units to the left and 1 unit up.
5. 400 cm^2 (New Area $=$ Original Area $\times$ (Scale Factor)$^2 = 25 \times 4^2 = 25 \times 16$)

Here is an exercise set focused on **Trigonometry** for Year 9 students in Queensland, concentrating on using the sine, cosine, and tangent ratios in right-angled triangles.

📐 Year 9 QLD Mathematics: Trigonometry Exercise Set

Note: For all calculations, round your final answer to **one decimal place**.

Scope: Trigonometric Ratios (SOH CAH TOA)

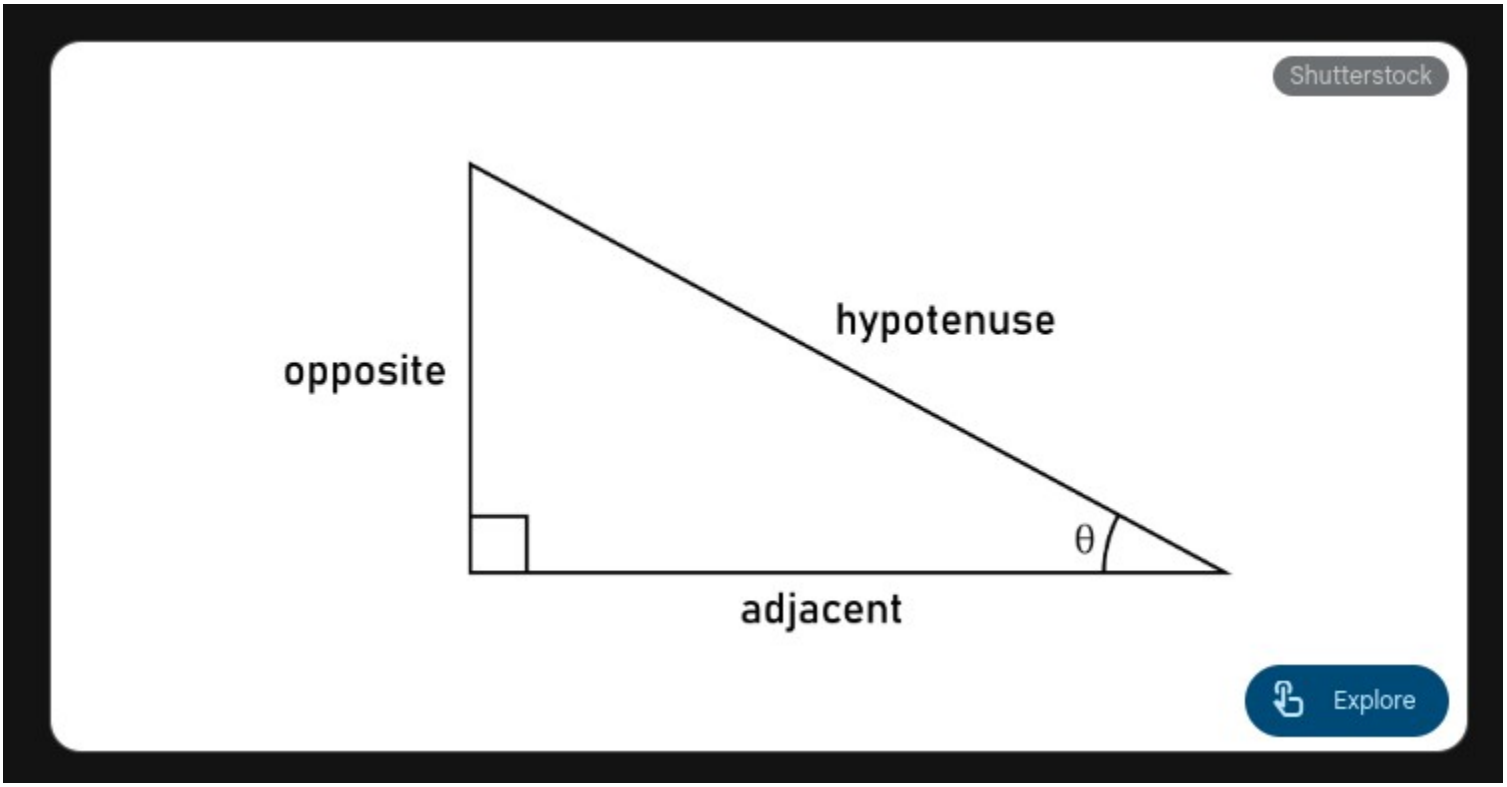
Remember the basic ratios for a right-angled triangle:

$$\sin(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

$$\cos(\theta) = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\tan(\theta) = \frac{\text{Opposite}}{\text{Adjacent}}$$

Next



1. **Finding a Side (Opposite):** In a right-angled triangle, the angle θ is 35° and the hypotenuse is 15 cm. Calculate the length of the side **opposite** the 35° angle.
2. **Finding a Side (Adjacent):** In a right-angled triangle, the angle θ is 55° and the hypotenuse is 8 m. Calculate the length of the side **adjacent** to the 55° angle.
3. **Finding a Side (Using Tan):** A ladder is leaning against a wall, making an angle of 68° with the ground. If the base of the ladder is 2 m away from the wall, how high up the wall does the ladder reach?
4. **Finding an Angle (Cosine):** A right-angled triangle has an adjacent side of 10 cm and a hypotenuse of 16 cm. Find the measure of the acute angle θ between them.
5. **Problem Solving:** A surveyor stands 50 m from the base of a tall building. She measures the **angle of elevation** to the top of the building to be 42°. Calculate the height of the building.

✅ Answers

Trigonometric Ratios (SOH CAH TOA)

1. **Finding a Side (Opposite):**
   - **Ratio:** Use Sine $(\sin)$ since you have Opposite and Hypotenuse.
   - **Calculation:** $\sin(35^\circ) = \frac{x}{15}$
   - $x = 15 \times \sin(35^\circ) \approx 15 \times 0.5736$
   - **Answer:** $x \approx \mathbf{8.6}$ cm
2. **Finding a Side (Adjacent):**
   - **Ratio:** Use Cosine $(\cos)$ since you have Adjacent and Hypotenuse.
   - **Calculation:** $\cos(55^\circ) = \frac{x}{8}$
   - $x = 8 \times \cos(55^\circ) \approx 8 \times 0.5736$
   - **Answer:** $x \approx \mathbf{4.6}$ m

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3. **Finding a Side (Using Tan):**
    - **Ratio:** Use Tangent ($\tan$) since you have Opposite (height) and Adjacent (distance from wall).
    - **Calculation:** $\tan(68^\circ) = \frac{h}{2}$
    - $h = 2 \times \tan(68^\circ) \approx 2 \times 2.475$
    - **Answer:** $h \approx \mathbf{5.0}$ m
4. **Finding an Angle (Cosine):**
    - **Ratio:** Use Cosine ($\cos$) since you have Adjacent and Hypotenuse.
    - **Calculation:** $\cos(\theta) = \frac{10}{16} = 0.625$
    - $\theta = \cos^{-1}(0.625)$
    - **Answer:** $\theta \approx \mathbf{51.3}^\circ$
5. **Problem Solving:**
    - **Ratio:** Use Tangent ($\tan$) since you have Opposite (height) and Adjacent (distance).
    - **Calculation:** $\tan(42^\circ) = \frac{h}{50}$
    - $h = 50 \times \tan(42^\circ) \approx 50 \times 0.9004$
    - **Answer:** $h \approx \mathbf{45.0}$ m

That concludes the comprehensive review of the Year 9 QLD Mathematics curriculum strands!