Skill Recap

- **Coordinate Geometry:** Gradients, distances, midpoints, line equations
- **Scale Bearings:** Bearings, component vectors, angles of elevation/depression
- **Similarity & Enlargement:** Scale factors, area/volume ratios, indirect measurements
- **Trigonometry:** SOHCAHTOA, sine/cosine rules, 3D geometry, and mixed applications

1. Plotting Points

Q: Plot and label points A(2, 3), B(-1, 4), and C(0, -2).

Solution:

- A: 2 right, 3 up
- B: 1 left, 4 up
- C: On the y-axis, 2 down

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2. Midpoint of a Line Segment

Q: Find the midpoint between (1, 2) and (5, 8).

$$\text{Midpoint} = \left(\frac{1+5}{2}, \frac{2+8}{2}\right) = \boxed{(3, 5)}$$

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3. Distance Between Two Points

Q: Find the distance between (-3, 4) and (2, -1).

$$\sqrt{(2-(-3))^2 + (-1-4)^2} = \sqrt{25+25} = \boxed{5\sqrt{2}}$$

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4. Gradient (Slope) of a Line

Q: Find the gradient of the line through (3, -2) and (7, 4).

$$\frac{4-(-2)}{7-3} = \frac{6}{4} = \boxed{\frac{3}{2}}$$

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5. Equation of a Line (Point-Slope Form)

Q: Write the equation of a line with gradient 2 passing through (1, 5).

$$y - 5 = 2(x-1) \Rightarrow \boxed{y = 2x + 3}$$

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6. Parallel Lines

Q: Equation of a line parallel to $y = 3x - 1$ through (0, 4)?

$$\text{Same gradient: } y = 3x + c \Rightarrow \boxed{y = 3x + 4}$$

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7. Perpendicular Lines

Q: Gradient of a line perpendicular to $y = -\frac{1}{4}x + 2$?

$$\text{Negative reciprocal of } -\frac{1}{4} = \boxed{4}$$

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8. Intercepts of a Line

Q: Find the x- and y-intercepts of $2x - 3y = 6$.

- x-intercept: $y = 0 \Rightarrow x = \boxed{3}$
- y-intercept: $x = 0 \Rightarrow y = \boxed{-2}$

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9. Graph Interpretation

Q: Find the equation of a line through (0, 1) and (2, 7).

$$\text{Gradient } m = \frac{7-1}{2-0} = 3 \Rightarrow \boxed{y = 3x + 1}$$

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10. Area from Coordinates

Q: Area of triangle with vertices at (0,0), (4,0), and (0,5)?

$$\text{Area} = \frac{1}{2} \times 4 \times 5 = \boxed{10 \text{ units}^2}$$

🧭 4.2 Scale Bearing (Incl. Angles of Elevation/Depression)

11. Compass Bearing Conversion

Q: Convert true bearing 135° to compass bearing.

$$\text{Direction: } 45^\circ east of south = \boxed{S45^\circ E}$$

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12. Angle of Elevation

Q: A 20m distance from a tower gives an angle of elevation of 30°. Find the height.

$$\tan 30^\circ = \frac{h}{20} \Rightarrow h = 20 \cdot \frac{1}{\sqrt{3}} \approx \boxed{11.55 \text{ m}}$$

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13. Angle of Depression

Q: A 50m cliff has a 15° depression angle to a boat. Find horizontal distance.

$$\tan 15^\circ = \frac{50}{d} \Rightarrow d \approx \boxed{186.60 \text{ m}}$$

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14. Scale Drawing

Q: A map uses a 1:10,000 scale. How many meters does 2cm represent?

$$2 \text{ cm} = 20{,}000 \text{ cm} = \boxed{200 \text{ m}}$$

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15. Combined Bearings (Vector Style)

Q: A ship sails 10km N30°E, then 5km S20°E. What is its final displacement?

Solution:

Involves vector components and cosine rule—best left for extension work.

🧩 4.3 Similarity & Enlargement

16. Similar Triangles

Q: In similar triangles, AB = 4cm, DE = 6cm, BC = 5cm. Find EF.

$$\frac{4}{6} = \frac{5}{EF} \Rightarrow EF = \frac{5 \times 6}{4} = \boxed{7.5 \text{ cm}}$$

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17. Area under Enlargement

Q: Shape enlarged by factor 2.5. Original area = 8cm². New area?

$$\text{New Area} = 8 \times (2.5)^2 = \boxed{50 \text{ cm}^2}$$

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18. Volume Enlargement

Q: Cube's side increases from 3cm to 6cm. Volume increases by?

$$\text{Scale factor} = 2 \Rightarrow \text{Volume factor} = 2^3 = \boxed{8}$$

📐 4.4 Trigonometry Basics

19. Pythagorean Theorem

Q: Find hypotenuse if legs are 6cm and 8cm.

$$c = \sqrt{6^2 + 8^2} = \sqrt{100} = \boxed{10\text{ cm}}$$

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20. Using SOHCAHTOA

Q: Opposite = 3, hypotenuse = 5. Find angle θ.

$$\sin\theta = \frac{3}{5} \Rightarrow \theta = \boxed{36.87^\circ}$$

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21. Trigonometric Word Problem

Q: A 10m ladder leans at 60°. Find the distance from base to wall.

$$\cos 60^\circ = \frac{d}{10} \Rightarrow d = \boxed{5\text{ m}}$$

22. Collinear Points

Q: Show that points A(1, 2), B(4, 5), and C(7, 8) are collinear.

Solution:

$$\text{Gradient of AB} = \frac{5-2}{4-1} = 1, \quad \text{Gradient of BC} = \frac{8-5}{7-4} = 1$$

Since the gradients are equal, the points lie on the same straight line.

Answer: $\boxed{\text{Collinear}}$

4.2 Scale Bearing (Continued)

23. True Bearing – Eastward Displacement

Q: A ship sails 20 km on a bearing of 120°. Find the eastward component of its displacement.

Solution:

Eastward component = $20\cos(30^\circ) = 20 \times \frac{\sqrt{3}}{2} = \boxed{10\sqrt{3}\text{ km}}$

Note: 120° from North = 30° from East

24. Angle of Depression

Q: From the top of a 100 m tower, the angle of depression to a car is 25°. How far is the car from the base of the tower?

Solution:

$$\tan 25^\circ = \frac{100}{d} \Rightarrow d = \frac{100}{\tan 25^\circ} \approx \boxed{214.5\text{ m}}$$

25. Displacement Using Bearings

Q: A plane flies 300 km on a bearing of N60°E, then 200 km on S30°E. Find its total displacement from the starting point.

Solution:

Break each leg into components:

- First leg:
  - North: $300 \cos 60^\circ = 150 \text{ km}$
  - East: $300 \sin 60^\circ \approx 259.8 \text{ km}$
- Second leg:
  - South: $200 \cos 30^\circ \approx 173.2 \text{ km}$
  - East: $200 \sin 30^\circ = 100 \text{ km}$

Net displacement:

- Vertical: $150 - 173.2 = -23.2 \text{ km (South)}$
- Horizontal: $259.8 + 100 = 359.8 \text{ km}$

Resultant distance:

$$\sqrt{(-23.2)^2 + (359.8)^2} \approx \boxed{360.5 \text{ km}}$$

4.3 Similarity and Enlargement (Continued)

26. Area Ratio of Similar Triangles

Q: If corresponding sides of two similar triangles are 4 cm and 6 cm, find the ratio of the areas.

Solution:

$$\left(\frac{6}{4}\right)^2 = \boxed{\frac{9}{4}}$$

27. Volume Enlargement Factor

Q: A sphere's radius increases from 2 cm to 6 cm. By what factor does its volume increase?

Solution:

$$\left(\frac{6}{2}\right)^3 = \boxed{27}$$

28. Missing Side in Similar Figures

Q: Two similar rectangles have widths 5 cm and 15 cm. If the smaller rectangle's length is 8 cm, find the larger one's length.

Solution:

$$\text{Scale factor} = \frac{15}{5} = 3, \quad \text{Length} = 8 \times 3 = \boxed{24\text{ cm}}$$

29. Shadow Length Problem

Q: A 1.8 m tall person casts a 3 m shadow. At the same time, a tree casts a 10 m shadow. How tall is the tree?

Solution:

$$\frac{h}{10} = \frac{1.8}{3} \Rightarrow h = \boxed{6\text{ m}}$$

30. Map Scale Conversion

Q: On a 1:50,000 map, two towns are 4 cm apart. What is the actual distance in kilometers?

Solution:

$$4 \times 50{,}000 = 200{,}000\text{ cm} = \boxed{2\text{ km}}$$

4.4 Trigonometry (Continued)

31. Finding an Angle from Triangle Sides

Q: In a right triangle with adjacent = 7 and hypotenuse = 25, find angle θ.

Solution:

$$\cos\theta = \frac{7}{25} \Rightarrow \theta \approx \boxed{73.74^\circ}$$

32. Trigonometric Identity

Q: If $\sin\theta = \frac{3}{5}$, find $\cos\theta$.

Solution:

$$\cos\theta = \sqrt{1 - \left(\frac{3}{5}\right)^2} = \boxed{\frac{4}{5}}$$

33. Height from Inclined Rope

Q: A 10 m rope makes an angle of 60° with the ground. How tall is the attached flagpole?

Solution:

$$\sin 60^\circ = \frac{h}{10} \Rightarrow h = 10 \times \frac{\sqrt{3}}{2} = \boxed{5\sqrt{3}\text{ m}}$$

34. Sine Rule (Non-Right Triangle)

Q: In triangle ABC, angle A = 30°, angle B = 45°, side a = 10 cm. Find side b.

Solution:

$$\frac{b}{\sin 45^\circ} = \frac{10}{\sin 30^\circ} \Rightarrow b = \frac{10 \times \sin 45^\circ}{\sin 30^\circ} = \boxed{10\sqrt{2}\ \text{cm}}$$

35. Cosine Rule (Non-Right Triangle)

Q: In triangle PQR, sides p = 7 cm, q = 5 cm, and angle R = 60°. Find side r.

Solution:

$$r^2 = 7^2 + 5^2 - 2 \times 7 \times 5 \times \cos 60^\circ = 49 + 25 - 35 = 39 \Rightarrow r = \sqrt{39} \approx \boxed{6.24\ \text{cm}}$$

4.5 Mixed Applications

36. Coordinate Geometry + Trigonometry

Q: Point A is at (0, 0) and point B at (5, 12). Find the angle AB makes with the x-axis.

Solution:

$$\tan\theta = \frac{12}{5} \Rightarrow \theta \approx \boxed{67.38^\circ}$$

37. Bearings + Trigonometry

Q: A ship sails 15 km on a bearing of 050°, then 20 km on 140°. Find its total distance from the starting point.

Solution:

$$d^2 = 15^2 + 20^2 - 2 \times 15 \times 20 \times \cos(90^\circ) = 225 + 400 = 625$$
$$d = \boxed{25\ \text{km}}$$

Angle between paths = 90°

38. Similarity + Trigonometry

Q: Two similar right triangles have hypotenuses 5 cm and 15 cm. If $\sin\theta = 0.6$ in the smaller triangle, find the corresponding opposite side in the larger triangle.

Solution:

Opposite side (small) = $5 \times 0.6 = 3\ \text{cm}$, Scale factor = 3

$$\text{Opposite (large)} = 3 \times 3 = \boxed{9\ \text{cm}}$$

39. Area with Two Sides and Included Angle

Q: Find the area of a triangle with sides 7 cm and 10 cm, and an included angle of 45°.

Solution:

$$\text{Area} = \frac{1}{2} \times 7 \times 10 \times \sin 45^\circ \approx \boxed{24.75 \text{ cm}^2}$$

40. Real-World Application: Composite Ladders

Q: A 5 m ladder leans at 60°, and a 3 m ladder at 45° against the same wall. How much higher does the first ladder reach?

Solution:

- First ladder: $5 \sin 60^\circ \approx 4.33 \text{ m}$
- Second ladder: $3 \sin 45^\circ \approx 2.12 \text{ m}$
- Difference: $4.33 - 2.12 = \boxed{2.21 \text{ m}}$