

13.1 Geometry: labelled facts, coordinates, circles and solids

Name: _____ Class: _____ Date: _____

KEY WORDS sector • scale factor

Objective

Use given relationships rather than a diagram's apparent scale; Connect coordinate distances, slopes and geometric properties; Distinguish linear, area and volume scale factors.

Original public tasks and locally authored marking guidance. No official score is assigned.

1 Key knowledge and worked examples

sector : A circle region bounded by two radii and their included arc.

scale factor : The multiplier relating corresponding lengths of similar figures.

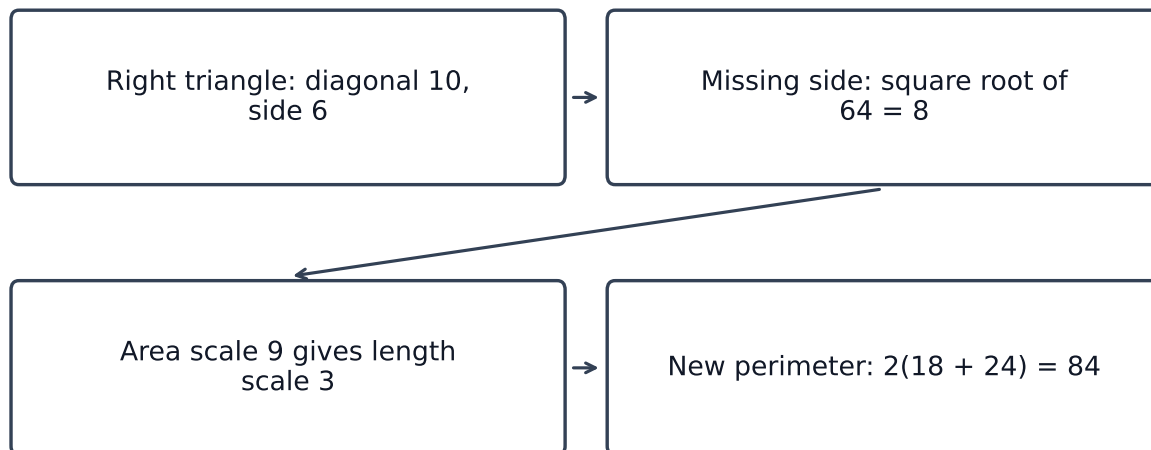
Extract the facts a diagram supplies: lengths, right-angle marks, parallel lines, circle radii and stated shape properties. Avoid measuring the screen. Angle sums and similarity give relationships when their conditions hold. Pythagorean reasoning needs a right triangle; it does not apply to every drawn triangle.

For two coordinates, use midpoint $((x_1+x_2)/2, (y_1+y_2)/2)$ and distance $\sqrt{((x_2-x_1)^2 + (y_2-y_1)^2)}$. Slope is $\Delta y/\Delta x$ when $\Delta x \neq 0$. A vertical line has no finite slope. Combine coordinate and shape facts where useful; perpendicular nonvertical lines have slopes whose product is -1 .

A circle has circumference $2\pi r$ and area πr^2 . An arc or sector uses its fraction of a full turn. Rectangular solids use volume lwh ; cylinders use $\pi r^2 h$. Surface area counts exposed faces or surfaces, not the enclosed volume. Attach units so an area answer is not confused with a length or volume.

For similar figures with linear factor k , corresponding areas multiply by k^2 and volumes by k^3 . If a question provides only an area ratio, take a square root to recover the length ratio; do not copy the area ratio directly. General-test geometry uses elementary relationships, with no trigonometry or calculus required for this lesson's tasks.

Points A(-1,2) and B(5,10) have $\Delta x=6$, $\Delta y=8$. Distance $d=\sqrt{6^2+8^2}=10$ and midpoint $M=(-1+5)/2, (2+10)/2)=(2,6)$. For a circle of radius 6, a 60° sector is $1/6$ of a full circle: area $=(60/360)\pi 6^2=6\pi$; arc length $=(60/360)2\pi 6=2\pi$. Enlarging every length by 3 multiplies area by 9 and volume by 27, not 3.



Follow the stated evidence and response instruction.

2 Practice

2.1 Points $A=(-1,2)$ and $B=(5,10)$ are given. Find their distance and midpoint. A right circular cylinder has radius 3 cm and height 4 cm. Find its volume and total surface area, including both ends.

3 Exam-style questions

3.1 A rectangle has diagonal 10 cm and one side 6 cm. A similar rectangle has area nine times as large. Find its perimeter. Explain which labelled facts permit Pythagoras, and whether the same calculation would hold for an arbitrary quadrilateral.

Solutions

2.1 Coordinate differences are six and eight. Distance is $\sqrt{6^2 + 8^2} = 10$ and midpoint $((-1 + 5)/2, (2 + 10)/2) = (2, 6)$. Cylinder volume is $V = \pi r^2 h = \pi(3 \text{ cm})^2(4 \text{ cm}) = 36\pi \text{ cm}^3$. Total area is $S = 2\pi r^2 + 2\pi r h = 2\pi(3 \text{ cm})^2 + 2\pi(3 \text{ cm})(4 \text{ cm}) = 42\pi \text{ cm}^2$. Volume and surface area measure different quantities.

3.1 A rectangle's adjacent sides are perpendicular. Its diagonal forms a right triangle, so the other side is $b = \sqrt{d^2 - a^2} = \sqrt{(10 \text{ cm})^2 - (6 \text{ cm})^2} = 8 \text{ cm}$. Area scale nine means length scale three. The new sides are 18 and 24 cm, giving perimeter $P = 2(a + b) = 2(18 + 24) \text{ cm} = 84 \text{ cm}$. An arbitrary quadrilateral need not supply a right angle, so its drawing alone would not justify the equation.

Local review checklist: follow every response instruction; support the answer with the stated evidence; explain rejected alternatives or an opposing view; check scope, restrictions and clarity. For writing, this is a formative checklist, not an official rubric score.