Geometry and transformations - Applications test

16 questions | 54 marks | 60 minutes

Use geometric reasoning to evaluate plans, repair procedures and justify constructions in practical situations.

Equivalent correct methods earn the corresponding marks.

1. A triangular sign has two angles of 54° and 61°. Find its third angle. [2 marks]

$180^\circ - 54^\circ - 61^\circ = 65^\circ.$

Answer: 65°

2. A map image is enlarged so that a 4 cm route becomes 10 cm. Find the positive scale factor. [2 marks]

$10 \div 4 = 2.5.$

Answer: 2.5

3. A rectangular logo is 5 cm by 4 cm. It is enlarged by factor 1.2. Find its new area. [3 marks]

Original area is 20 cm².

Area factor is $1.2^2 = 1.44$, so area $= 28.8 \text{ cm}^2$.

Answer: 28.8 cm²

4. A safety sign is translated to a new position. State whether its perimeter, area and angles change. [2 marks]

A translation moves every point by the same displacement without changing size or shape.

Answer: All three stay unchanged.

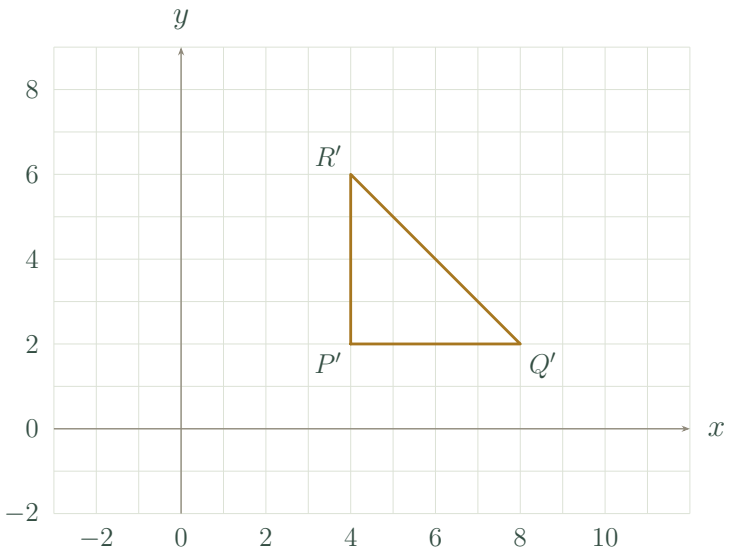
5. A design uses centre $C(2, 1)$. Enlarge corner $P(5, 3)$ by factor 2. [3 marks]

$P - C = (3, 2).$

$C + 2(P - C) = (2, 1) + (6, 4) = (8, 5).$

Answer: $P'(8, 5).$

6. A logo has $P(1,1)$, $Q(3,1)$, $R(1,3)$. Translate it by $(1,0)$, then enlarge by factor 2 from the origin. Draw the final triangle on the supplied grid. [4 marks]



The intermediate vertices are $(2,1)$, $(4,1)$, $(2,3)$.

Double both coordinates of each point and join matching vertices.

Answer: $P'(4,2)$, $Q'(8,2)$, $R'(4,6)$.

7. A fountain must be equally far from gates $A(0,0)$ and $B(8,0)$, and lie on path $y=3$. Find its position and explain the construction line used. [4 marks]

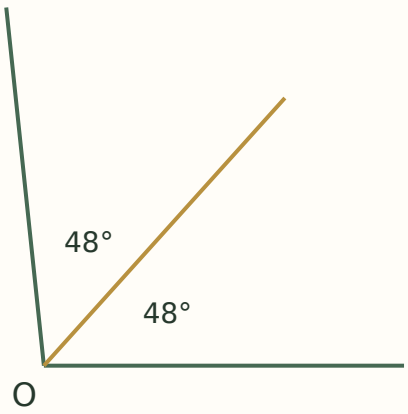
Equal distances require the perpendicular bisector of AB.

Its midpoint is $(4,0)$, and AB is horizontal.

Intersect vertical line $x=4$ with path $y=3$.

Answer: $(4,3)$, using the perpendicular bisector $x=4$.

8. A 96° entrance angle is to be divided equally by a compass construction. Describe the steps and give each angle. [4 marks]



Equal angles, each 48°. Sketch not to scale.

Mark equal-distance points on both arms with an arc from the vertex.

Draw equal-radius arcs from those points to meet inside.

Join the vertex to that crossing; $96^\circ \div 2 = 48^\circ$.

Answer: 48° and 48°.

9. A plotting robot doubles x and triples y. It is claimed to enlarge every figure. Test a 2 cm by 2 cm square and explain the result. [4 marks]

The image side ratio becomes $4:6$ instead of $1:1$.

A true enlargement uses the same factor in every direction.

Answer: Its image is 4 cm by 6 cm, so it is not an enlargement of the square.

10. A plan tells a worker to construct a bisector of a 10 cm segment using radius 6 cm from A and 7 cm from B. Repair the instruction and explain why. [3 marks]

Both radii must exceed 5 cm and be equal.

Equal radii make each crossing equally far from the two endpoints.

Answer: Use the same radius, for example 6 cm, from both endpoints.

11. A similar triangular shade has an angle of 68° before enlargement. A designer changes it to 72° in the image. Explain why the revised shade is not a true enlargement. [2 marks]

Enlargement changes size, not angle measures.

Answer: Corresponding angles must stay equal, so the image angle must remain 68°.

12. A screen rounds all image coordinates to the nearest whole number after a factor-$\frac{1}{2}$ enlargement from the origin. [5 marks]

(a) Find the exact image of $P(1, 5)$. [2 marks]

Multiply each coordinate by $\frac{1}{2}$.

Answer: $(0.5, 2.5)$

(b) Explain why rounding those coordinates can spoil the enlargement, and suggest a repair. [3 marks]

The original point and image must align with the origin.

Preserve the calculated values until display precision is chosen.

Answer: Rounding changes the ray and distance ratio; keep exact halves or use half-unit grid points.

13. A triangular roof brace has two equal sloping sides and a 46° vertex angle. Find its two base angles and justify your method. [3 marks]

Equal sides give equal base angles.

The remaining sum is $180^\circ - 46^\circ = 134^\circ$.

Each base angle is 67°.

Answer: 67° each.

14. A pupil checks a transformation rule on $(0, 0)$ only and concludes the rule doubles every coordinate correctly. Why is this weak evidence? Give two better points to test. [4 marks]

Nonzero coordinates reveal whether each coordinate is scaled.

A negative coordinate checks sign handling.

Tests can find errors, but a general argument is still needed.

Answer: Many wrong rules fix the origin. For example test $(2, 3)$ and $(-1, 4)$.

15. A garden shape has perimeter 24 m and area 32 m². A similar garden has positive scale factor 1.5. [5 marks]

(a) Find the new perimeter and area. [3 marks]

$24 \times 1.5 = 36.$

$32 \times 1.5^2 = 72.$

Answer: 36 m and 72 m²

(b) Paving costs 2 dollars per square metre. Find the extra paving cost for the larger garden. [2 marks]

The extra area is $72 - 32 = 40 \text{ m}^2$.

$40 \times 2 = 80$ dollars.

Answer: 80 dollars

16. A worker says a compass-made bisector is correct because it looks centred. Give the two geometric conditions to check and a reason the equal-radius construction guarantees them. [4 marks]

Each crossing is equally far from the two endpoints.

The line through two such crossings is the perpendicular bisector, not merely an estimated central line.

Answer: It must pass through the midpoint and meet the segment at 90°. Equal-radius crossings lie on the perpendicular bisector.