

Geometry and trigonometry · supported focus

Supported focus · HL

Supported scope

- Supported HL focus. First assessment 2021; current through 2028.
First-assessment-2029 course is separate.. Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Geometry · 1.1

Reasoning

A model has lengths one third of the real object. How much smaller are its area and volume? This lesson studies scale factor : The multiplier that relates corresponding lengths in similar shapes.

Geometry · 2.1

Reasoning

For similar shapes with length scale factor k , areas scale by k^2 and volumes by k^3 . State angle reasons explicitly. A circle's tangent is perpendicular to the radius at the contact point. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Geometry · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$\frac{A_2}{A_1} = k^2, \quad \frac{V_2}{V_1} = k^3$$

Geometry · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Geometry · 3.3

Reasoning

If model-to-real length factor is 3, a model area of 12 cm^2 gives $12 \times 3^2 = 108 \text{ cm}^2$ and a model volume of 8 cm^3 gives $8 \times 3^3 = 216 \text{ cm}^3$. A cylinder with $r=3, h=5$ has volume $\pi r^2 h = 45\pi$.

Geometry · 4.1

Reasoning

Equal angles alone establish similarity, not equal size. Use corresponding lengths in the same order. Convert linear units before calculating area or volume, or square/cube the conversion factor correctly. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Geometry · 4.2

Reasoning

Doubling every length of a solid doubles its volume. This claim is false. Explain which definition or assumption it violates.

Geometry · 5.1

Reasoning

A geometric proof should name the relevant theorem, identify the equal angle or ratio, and draw the conclusion. A scale drawing is evidence only when the task permits measurement. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Geometry · 6.1

Reasoning

Current first-assessment-2021 Analysis and Approaches HL. This is authored concept support; the full guide is needed to certify every objective. Give the method before the final answer, and use the paper's calculator and formula rules. Review a wrong answer by locating the first invalid step.

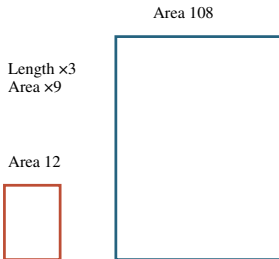
Geometry · 6.2

Reasoning

The multiplier that relates corresponding lengths in similar shapes. Choose the relationship, show the method, check its assumptions and interpret the result.

Geometry · diagram

A length scale factor is squared for area



- Original teaching diagram: Angle reasoning, similarity and mensuration
- Use the labels and the stated model together.

Geometry · original transfer

Your turn

Two similar closed solids have volume ratio 27:8. Find length and area ratios; explain why doubling a length would not double volume.

Geometry · transfer reasoning

Method and interpretation

Length ratio 3:2, area 9:4. Area scales as the square and volume as the cube of the length factor, assuming genuine geometric similarity.

Trig Basic · 1.1

Reasoning

A ladder reaches a height of 4 m while its foot is 3 m from a wall. Which sides are known, and which angle do we need? This lesson studies hypotenuse : The side opposite the right angle in a right-angled triangle.

Trig Basic · 2.1

Reasoning

In a right triangle $a^2 + b^2 = c^2$; $\sin\theta = \text{opposite/hypotenuse}$, $\cos\theta = \text{adjacent/hypotenuse}$ and $\tan\theta = \text{opposite/adjacent}$. For other triangles, use the sine or cosine rule, or $\text{area} = ab \sin C/2$. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Trig Basic · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$a^2 + b^2 = c^2, \quad \tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

Trig Basic · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Trig Basic · 3.3

Reasoning

The ladder length is $c = \sqrt{3^2 + 4^2} = 5$ m. Its angle to the ground satisfies $\tan\theta = 4/3$, so $\theta \approx 53.1^\circ$. With two sides 6 and 8 enclosing 60° , $c^2 = 6^2 + 8^2 - 2 \times 6 \times 8 \cos 60^\circ = 52$.

Trig Basic · 4.1

Reasoning

Label sides relative to the chosen angle. Pythagoras needs a right angle. A calculator angle mode error can produce a plausible but wrong result. Keep unrounded values for later steps. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Trig Basic · 4.2

Reasoning

Pythagoras applies to every triangle, including triangles without a right angle. This claim is false. Explain which definition or assumption it violates.

Trig Basic · 5.1

Reasoning

Use a plan or elevation for a three-dimensional problem before applying a triangle rule. Explain why the chosen triangle contains the required length or angle. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Trig Basic · 6.1

Reasoning

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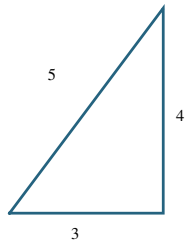
Trig Basic · 6.2

Reasoning

The side opposite the right angle in a right-angled triangle. Choose the relationship, show the method, check its assumptions and interpret the result.

Trig Basic · diagram

Label the known sides before choosing a rule



- Original teaching diagram: Right triangles and non-right triangles
- Use the labels and the stated model together.

Trig Basic · original transfer

Your turn

A triangle has sides $a=7$, $b=10$ and angle $A=30^\circ$. Determine how many triangles are possible and give the possible B angles.

Trig Basic · transfer reasoning

Method and interpretation

Sine rule gives $\sin B = 10 \sin 30^\circ / 7 = 5/7$. $B \approx 45.585^\circ$ or 134.415° ; both leave a positive third angle. The ambiguous SSA case has two solutions, unlike a right-triangle shortcut.

Trig Advanced · 1.1

Reasoning

A rotating wheel sweeps an arc. Radians let its angle connect directly to the distance travelled along the rim. This lesson studies radian : The angle subtended by an arc whose length equals the radius.

Trig Advanced · 2.1

Reasoning

For θ in radians, arc length $s=r\theta$ and sector area $A=r^2\theta/2$. Use $\sin^2\theta+\cos^2\theta=1$ and angle identities to simplify or solve. List every solution in the stated interval. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Trig Advanced · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$s = r\theta, \quad A = \frac{1}{2}r^2\theta, \quad \sin^2 \theta + \cos^2 \theta = 1$$

Trig Advanced · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Trig Advanced · 3.3

Reasoning

For $r=4$ and $\theta=\pi/3$, $s=4\pi/3$ and $A=8\pi/3$. Solving $\sin x=1/2$ on $0\leq x<2\pi$ gives $x=\pi/6$ and $5\pi/6$. For $\sin 2x=1/2$, solve first on $0\leq 2x<4\pi$ before dividing by 2.

Trig Advanced · 4.1

Reasoning

A calculator's inverse sine gives one principal value. It does not give every solution. Dividing by $\sin x$ can discard solutions where $\sin x=0$; check that case first. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Trig Advanced · 4.2

Reasoning

The principal inverse sine value is always the only solution in a full turn. This claim is false. Explain which definition or assumption it violates.

Trig Advanced · 5.1

Reasoning

Choose an identity that reduces the equation to one trigonometric function. Keep exact familiar angles where possible, and check each solution against the original equation. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Trig Advanced · 6.1

Reasoning

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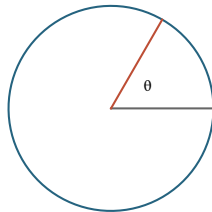
Trig Advanced · 6.2

Reasoning

The angle subtended by an arc whose length equals the radius. Choose the relationship, show the method, check its assumptions and interpret the result.

Trig Advanced · diagram

A radius fixes distance from the centre



radius $\times$ angle gives arc length

- Original teaching diagram: Radians, identities and trigonometric equations
- Use the labels and the stated model together.

Trig Advanced · original transfer

Your turn

Solve $2 \sin^2 x - \sin x - 1 = 0$ for $0 \leq x < 2\pi$, showing why no solutions are lost.

Trig Advanced · transfer reasoning

Method and interpretation

Factor $(2 \sin x + 1)(\sin x - 1) = 0$. $\sin x = 1$ gives $\pi/2$; $\sin x = -1/2$ gives $7\pi/6, 11\pi/6$. Both allowed roots are considered and the endpoint interval is respected.

Vectors · 1.1

Reasoning

Walking 4 m east and 3 m north gives a displacement of 5 m, even though the travelled distance is 7 m. This lesson studies resultant : The vector sum representing the combined displacement or force.

Vectors · 2.1

Reasoning

Add corresponding vector components. A displacement from A to B is $\overrightarrow{OB} - \overrightarrow{OA}$. Parallel vectors are scalar multiples. A vector has magnitude and direction; a distance is a scalar. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Vectors · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}, \quad |\mathbf{v}| = \sqrt{v_x^2 + v_y^2}$$

Vectors · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Vectors · 3.3

Reasoning

With $a=(4,1)$ and $b=(1,3)$, $a+b=(5,4)$. Their scalar product is $a \cdot b=4 \times 1+1 \times 3=7$. The magnitude of a is $\sqrt{17}$. For $A=(1,2)$, $B=(5,5)$, $AB=(4,3)$ and $|AB|=5$.

Vectors · 4.1

Reasoning

The order of subtraction matters: $\overrightarrow{BA} = -\overrightarrow{AB}$. Proving parallelism needs a scalar-multiple relation; a sketch alone is insufficient. Negative enlargement reverses position about its centre. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Vectors · 4.2

Reasoning

$\vec{AB}$ and $\vec{BA}$ always have the same components. This claim is false. Explain which definition or assumption it violates.

Vectors · 5.1

Reasoning

For a translation, every point uses the same displacement. For advanced line problems, distinguish the position vector from a direction vector and solve parameter equations consistently. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Vectors · 6.1

Reasoning

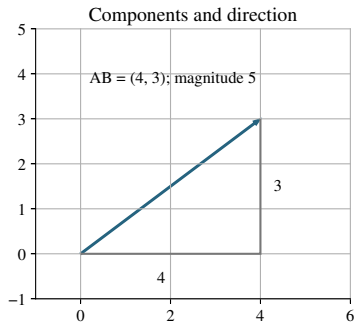
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Vectors · 6.2

Reasoning

The vector sum representing the combined displacement or force. Choose the relationship, show the method, check its assumptions and interpret the result.

Vectors · diagram



- Original teaching diagram: Vectors and transformation geometry
- Use the labels and the stated model together.

Vectors · original transfer

Your turn

Points $A=(1, 2, 0)$, $B=(3, 2, 1)$, $C=(1, 5, 0)$. Find $\overrightarrow{AB} \cdot \overrightarrow{AC}$ and decide whether the angle at A is right; distinguish a zero vector exception.

Vectors · transfer reasoning

Method and interpretation

$AB=(2, 0, 1)$, $AC=(0, 3, 0)$, dot 0. Both nonzero, so angle $\pi/2$. A zero dot product involving a zero vector would not define an angle.

Check yourself

- Explain scale factor using the stated model.
- Explain hypotenuse using the stated model.
- Change one value in the original transfer; explain which assumption still matters.