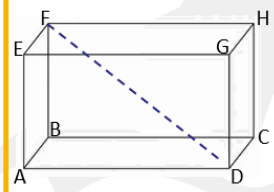
SUBJECT: Maths – Y11H. Spring 1

UNIT: Pythagoras

SANDHILL VIEW EST. 1953 ACHIEVE · ASPIRE · ENJOY

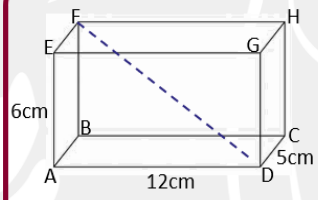
Key Concepts



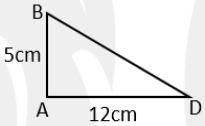
The **plane** of a cuboid is a flat 2 dimensional surface.
An example of a plane is ABCD.

An example of a **diagonal** in a cuboid is FD.

Examples



Calculate the length BD:

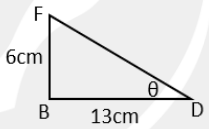


$BD^2 = 12^2 + 5^2$

$BD = \sqrt{169}$

$BD = 13cm$

Calculate the angle between FD and the plane ABCD:

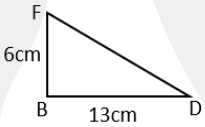


$tan\theta = \frac{6}{13}$

$\theta = tan^{-1}\left(\frac{6}{13}\right)$

$\theta = 24.78^o$

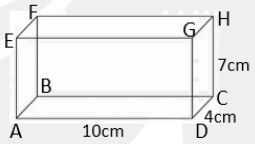
Calculate the length FD:



$FD^2 = 13^2 + 6^2$

$FD = \sqrt{205}$

$FD = 14.32cm$



1) Calculate the length AC
2) Calculate the length AH
3) Calculate the angle between AH and the plane ABCD.

Key Words Sine Cosine Tangent 3D Plane Diagonal

ANSWERS 1) 10.77cm 2) 12.84cm 3) 33.02°

SUBJECT: Maths

UNIT: Transformations

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Key Concepts

A **reflection** creates a mirror image of a shape on a coordinate graph. The mirror line is given by an equation eg. $y = 2, x = 2, y = x$. The shape does not change in size.
A **rotation** turns a shape on a coordinate grid from a given point. The shape does not change size but does change orientation.
A **translation** moves a shape on a coordinate grid. Vectors are used to instruct the movement:

$\begin{pmatrix} x \\ y \end{pmatrix}$ → Positive-Right, Negative - Left; ↑ Positive-Up, Negative - Down

An **enlargement** changes the size of an image using a scale factor from a given point.

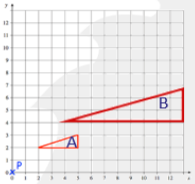
A **positive scale factor** will increase the size of an image.

A **fractional scale factor** will reduce the size of an image.

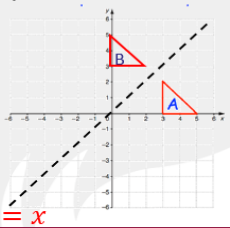
A **negative scale factor** will place the image on the opposite side of the centre of enlargement, with the image inverted.

Examples

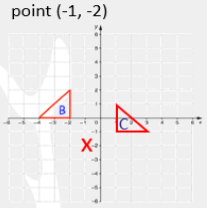
Enlarge shape A by scale factor 2 from point P.



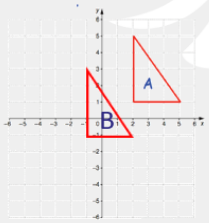
Reflect shape A in the line $y = x$. Label it B.



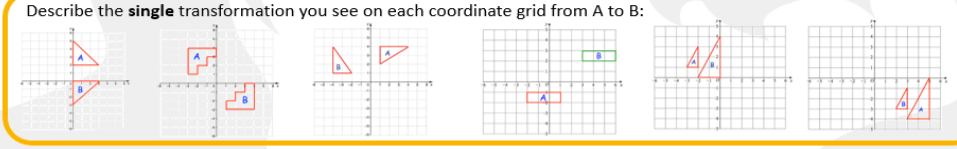
Rotate shape B from the point (-1, -2)



Translate shape A by $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$. Label it B



Describe the **single** transformation you see on each coordinate grid from A to B:



ANSWERS: a) reflection, $y = 1$ b) reflection $y = x$ c) rotation, centre (0,0), 90° anticlockwise d) translation $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$ e)) enlarge, centre (-4,2) scale factor 2 f) enlarge, centre (1,-2) scale factor $\frac{1}{2}$

Key Words Rotate Clockwise Anticlockwise Centre Degrees Reflect Translate Vector Scale Factor

SUBJECT: Maths – Y11H. Spring 1

UNIT: Further Trigonometry

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Key Concepts

Sine rule

To calculate a missing side:

$$\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$$

To calculate a missing angle:

$$\frac{sinA}{a} = \frac{sinB}{b} = \frac{sinC}{c}$$

Cosine rule

To calculate a missing side:

$$a^2 = b^2 + c^2 - 2bccosA$$

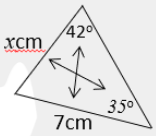
To calculate a missing angle:

$$cosA = \frac{b^2 + c^2 - a^2}{2bc}$$

Area of a triangle using sine

$$area = \frac{1}{2}absinC$$

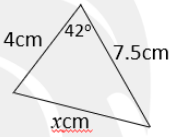
Examples



$$\frac{x}{sin35} = \frac{7}{sin42}$$

$$x = \frac{sin35 \times 7}{sin42}$$

$$x = 6.0cm$$

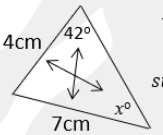


$$a^2 = b^2 + c^2 - 2bccosA$$

$$x^2 = 4^2 + 7.5^2 - 2 \times 4 \times 7.5 \times cos42$$

$$x^2 = 27.66$$

$$x = \sqrt{27.66} = 5.26cm$$

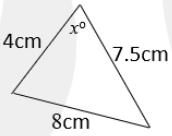


$$\frac{sinx}{4} = \frac{sin42}{7}$$

$$sinx = \frac{sin42 \times 4}{7}$$

$$x = sin^{-1}\left(\frac{sin42 \times 4}{7}\right)$$

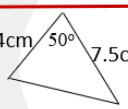
$$x = 22.5^o$$



$$cosA = \frac{4^2 + 7.5^2 - 8^2}{2 \times 4 \times 7.5}$$

$$A = cos^{-1}\left(\frac{4^2 + 7.5^2 - 8^2}{2 \times 4 \times 7.5}\right)$$

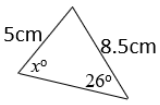
$$A = 82.1^o$$



$$area = \frac{1}{2} \times 4 \times 7.5 \times sin50$$

$$area = 11.49cm^2$$

1a) Calculate x
b) Calculate the area of the triangle



2a) Calculate x
b) Calculate the area of the triangle

Key Words Sine, Cosine, Side, Angle, Inverse, 2D

ANSWERS 1a) 4.57cm b) 9.32cm² 2a) 48.18° b) 20.45cm²

SUBJECT: Maths

UNIT: Bounds

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Key Concepts

The boundaries of a number derive from **rounding**.

E.g. State the boundaries of 360 when it has been rounded to 2 significant figures:

$$355 \leq x < 365$$

E.g. State the boundaries of 4.5 when it has been rounded to 2 decimal place:

$$4.45 \leq x < 4.55$$

These boundaries can also be called the **error interval** of a number.

	+	-	×	÷
Upper bound answer	$UB_1 + UB_2$	$UB_1 - LB_2$	$UB_1 \times UB_2$	$UB_1 \div LB_2$
Lower bound answer	$LB_1 + LB_2$	$LB_1 - UB_2$	$LB_1 \times LB_2$	$LB_1 \div UB_2$

Examples

When completing calculations involving boundaries we are aiming to find the greatest or smallest answer.

A restaurant provides a cuboid stick of butter to each table. The dimensions are 30mm by 30mm by 80mm, correct to the nearest 5mm. Calculate the upper and lower bounds of the volume of the butter.

$$Volume = l \times w \times h$$

$$Upper\ bound = 32.5 \times 82.5 \times 32.5$$
$$= 87140.63mm^3$$

$$Lower\ bound = 27.5 \times 77.5 \times 27.5$$
$$= 58609.38mm^3$$

$$D = \frac{x}{y}$$

x = 99.7 correct to 1 decimal place.
y = 67 correct to 2 significant figures.
Work out an upper and lower bounds for D.

$$Upper\ bound\ D = \frac{99.75}{66.5} = 1.5$$

$$Lower\ bound\ D = \frac{99.65}{67.5} = 1.48$$

Key Words Bound, Upper, Lower, Accuracy, Rounding

1) Jada has 100 litres of oil, correct to the nearest litre.
The oil is poured into tins of volume 1.5 litres, correct to one decimal place.
Calculate the upper and lower bounds for the number of tins that can be filled.

2) There are 110 identical marbles in a bag. A marble is taken and weighed as 15.6 g to the nearest tenth of a gram. Find the upper and lower bounds for the weight of all the marbles.

ANSWERS: 1) LB = 69.3 ≈ 69 UB = 64.2 ≈ 64 2) LB = 1710.5 g UB = 1721.5 g