**Trigonometry II – 3D Pythagoras and Trigonometry**

**Test Your Understanding**
[AQA Jan 2013 Paper 2] The diagram shows a cuboid $ABCDPQRS$ and a pyramid $PQRSV$. $V$ is directly above the centre $X$ of $ABCD$.

a) Work out the angle between the line $VA$ and the plane $ABCD$. (Reminder: ‘Drop’ $VA$ onto the plane)

b) Work out the angle between the planes $VQR$ and $PQRS$.

**Exercise 2**

1. A cube has sides 8cm. Find:
a) The length $AB$.
b) The angle between $AB$ and the horizontal plane.
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2. A radio tower 150m tall has two support cables running 300m due East and some distance due South, anchored at $A$ and $B$. The angle of inclination to the horizontal of the latter cable is $50°$ as indicated.

a) Find the angle between the cable attached to $A$ and the horizontal plane.

b) Find the distance between $A$ and $B$.

1. Frost Manor is as pictured, with $EFGH$ horizontally level.

a) Find the angle between the line $AG$ and the plane $ABCD$.
b) Find the angle between the planes $FGIJ$ and $EFGH$.
2. A school buys a set of new ‘extra comfort’ chairs with its seats pyramid in shape. $X$ is at the centre of the base of the pyramid, and $M$ is the midpoint of $BC$.

a) By considering the triangle $EBC$, find the length $EM$. **16cm**

b) Hence determine the angle between the triangle $EBC$ and the plane $ABCD$.

1. [June 2013 Paper 2] $ABCDEFGH$ is a cuboid. $M$ is the midpoint of $HG$. $N$ is the midpoint of $DC$.

2. Show that $BN=$ 7.5m
3. Work out the angle between the line $MB$ and the plane $ABCD$.
4. Work out the **obtuse** angle between the planes $MNB$ and $CDHG$.
5. [Set 3 Paper 2] The diagram shows part of a skate ramp, modelled as a triangular prism.

$ABCD$ represents horizontal ground. The vertical rise of the ramp, $CF$, is 7 feet. The distance $BC=24$ feet.

You are given that
$$gradient=\frac{vertical rise}{horizontal distance}$$

a) The gradient of $BF$ is twice the gradient of $AF$. Write down the distance $AC$.

b) Greg skates down the ramp along $FB$. How much further would he travel if he had skated along $FA$.

1. 
a) Determine the angle between the line $AI$ and the plane $ABCD$.

b) Determine the angle between the planes $FHI$ and $EFGH$.

1. A ‘truncated pyramid’ is formed by slicing off the top of a square-based pyramid, as shown. The top and bottom are two squares of sides 2 and 4 respectively and the slope height 3.

Find the angle between the sloped faces with the bottom face.
* a) $X$ is a point on $AB$ such that $XC$ is the line of greatest slope on the triangle $ABC$. Determine the length of $AX$.

b) Hence determine $DX$.

c) Hence find the angle between the planes $ABC$ and $ABD$.

**Exercise 3**

1. [June 2012 Paper 2 Q13]
Work out angle $x$.


2. Here is a triangle. Work out $θ$.

3. Use the cosine rule to determine $x$.



1. Given that the area of the triangle is 24cm2. Find the values of $x$ and $y$.



1. The angle $θ$ is obtuse. Determine $θ$.



1. [June 2012 Paper 1] Triangle ABC has an obtuse angle at C. Given that $\sin(A)=\frac{1}{4}$, use triangle $ABC$ to show that angle $B=60°$.

2. [June 2013 Paper 2 Q23] In triangle $ABC$, $AP$ bisects angle $BAC$.

Use the sine rule in triangles $ABP$ and $ACP$ to prove that $\frac{AB}{AC}=\frac{BP}{PC}$.
