Level 2 Further Maths

3D Pythagoras
3D Trigonometry

Ensure you have: Pencil or pen

Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

Revision for this topic

www.corbettmaths.com/more/further-maths/
Can a one metre rod fit inside of the box?
Explain your answer.

\[ AB^2 = 40^2 + 85^2 \]
\[ AB^2 = 8825 \]
\[ AB = 93.94 \text{ cm} \]

\[ AC^2 = AB^2 + 40^2 \]
\[ AC^2 = 8825 + 1600 \]
\[ AC^2 = 10425 \]
\[ AC = 102.103 \text{ cm (to 3 dp)} \]

Yes
2. ABCDEFGH is a cuboid

AB = 8cm
BC = 3cm
CG = 4cm

(a) Work out the length of BH

\[ \begin{align*}
80^2 &= 3^2 + 8^2 \\
80^2 &= 9 + 64 \\
80^2 &= 73 \\
80 &= \sqrt{73}
\end{align*} \]

\[ \begin{align*}
8H^2 &= 4^2 + 80^2 \\
8H^2 &= 16 + 73 \\
8H^2 &= 89 \\
8H &= \sqrt{89}
\end{align*} \]

\[ 8H = \frac{89}{8} \text{ cm} \]  

(b) Work out the size of the angle between BH and the plane ABCD

\[ \tan \theta = \frac{4}{\sqrt{73}} \]

\[ \theta = 25.087^\circ \]
3. Shown below is the square based pyramid ABCDE.

F is the midpoint of CD.
M is the point on the base directly below the vertex E.

![Diagram of a square pyramid with labeled points]

(a) Work out the length of EM

\[
AC^2 = 4^2 + 4^2
\]
\[
AC^2 = 32
\]
\[
AC = 4\sqrt{2}
\]
\[
MC = 2\sqrt{2}
\]

\[
EC^2 = EM^2 + EM^2
\]
\[
EM^2 = 41
\]
\[
EM = 6.403 \text{ cm}
\]

(b) Work out the angle between the line EF and plane ABCD

\[
\tan \theta = \frac{\sqrt{61}}{2}
\]
\[
\theta = 72.65^\circ
\]
4. Shown below is a triangular prism. Triangle ABC is a right angle triangle.

(a) Work out the length of BF

\[ BC = 10 \text{ cm} \] (by the Pythagorean triple \(6/8/10\))

\[ BF^2 = BC^2 + CF^2 \]
\[ = 100 + 144 \]
\[ BF^2 = 244 \]
\[ BF = 2\sqrt{61} \]

\[ 15.62 \text{ cm} \]

(b) Work out the angle between the plane BEFC and plane ABED

\[ \tan \theta = \frac{6}{6} \]

\[ \theta = 36.87^\circ \]
Calculate the volume of this cone.

\[ 4^2 + h^2 = 18^2 \]
\[ h^2 = 308 \]
\[ h = 2 \sqrt{77} \]
\[ h = 17.55 \text{ cm} \]

\[ V = \frac{1}{3} \pi r^2 h \]
\[ = \frac{1}{3} \times 3.14 \times 4^2 \times (2 \sqrt{77}) \]
\[ = 294.05 \text{ cm}^3 \]

\[ 294.05 \text{ cm}^3 \]

(4)
ABCDEFGH is a cuboid.

P is a point on AB such that AP:PB is 1:2
Q is a point on GH such that GQ:QH is 2:3

Calculate the angle between the line PQ and the plane ABCD.

\[ PR = 10 \text{ cm} \quad \text{since} \quad PS = 6 \text{ cm} \quad \text{and} \quad RS = 8 \text{ cm} \]

\[ \tan \theta = \frac{8}{10} \]

\[ \theta = 38.66^\circ \]
7. Shown below is a rectangular-based pyramid. The apex E is directly over the base of the pyramid.

AD = 8cm  CD = 6cm  CE = 11cm

M is the midpoint of the line CD.

Work out the size of angle AME

\[ AE = 11 \text{ cm} \]
\[ EM^2 = 4^2 + (\sqrt{56})^2 \]
\[ EM^2 = 16 + 56 \]
\[ EM = \sqrt{72} \]
\[ AM^2 = 3^2 + 8^2 \]
\[ AM = \sqrt{73} \]
\[ AC^2 = AD^2 + CD^2 \]
\[ AC^2 = 8^2 + 6^2 \]
\[ AC^2 = 100 \]
\[ AC = 10 \]
\[ CF = 5 \]
\[ EF^2 = 11^2 - 5^2 \]
\[ EF^2 = 96 \]
\[ EF = \sqrt{96} \]
\[ \cos \theta = \frac{(\sqrt{113})^2 + (\sqrt{73})^2 - 11^2}{2 \times \sqrt{113} \times \sqrt{73}} \]
\[ \cos \theta = \frac{\sqrt{59}}{180.66} \]
\[ \theta = 69.03^\circ \]
8. The diagram shows a cuboid and a pyramid. The apex of the pyramid, I, is directly above the centre, M, of ABDC.

(a) Calculate the angle between the line DI and the plane ABDC

\[ m \theta = 3.5^2 + 4.5^2 \]
\[ m \theta = \frac{51.25}{2} \]

\[ \tan \theta = \frac{8}{\sqrt{51.25}} \]

\[ \theta = 54.5^\circ \]

(b) Calculate the angle between planes EHI and ACHE

\[ 90 + 45 = 135^\circ \]