Mathematics Higher

Assessment 1

Revision Materials

Vectors and Straight line Skill Builder

Layout and content of the Unit Assessment will be different. This is not meant to be a carbon copy of the Unit Assessment. This booklet is an opportunity to practice all of the essential skills required to pass the Unit Assessment.

This booklet should be used to identify any areas for improvement **before** you sit the Unit assessment for the first time.

Unit	Assessment standard	Description
H4LC 76 Expressions and Functions	EF1.4 Applying geometric skills to vectors	The sub-skills in the Assessment Standard are: ♦ determining the resultant of vector pathways in three dimensions ♦ working with collinearity ♦ determining the coordinates of an internal division point of a line ♦ evaluating a scalar product given suitable information and determining the angle between two vectors
	EF2.1 Interpreting a situation where mathematics can be used and identifying a valid strategy	Assessment Standard 2.1 is transferable across Units. For candidates undertaking the Course, Assessment Standard 2.1 should be achieved on **at least two** occasions from across the Course.
H22J 76 Applications	APP1.1 Applying algebraic skills to rectilinear shapes	The sub-skills in the Assessment Standard are: ♦ finding the equation of a line parallel to, and a line perpendicular to, a given line ♦ using $m = \tan\theta$ to calculate a gradient or angle

- EF1.4 Applying geometric skills to vectors:
- Sub-skills
- Determining the resultant of vector pathways in three dimensions
- Working with collinearity

Q1 The points $A, B\ and\ C$ have coordinates $(10,4,5), (1,-10,-4), (-17,m,-22)$ respectively.

a) Write down the components of $\overrightarrow{AB}$.

b) $A, B\ and\ C$ are collinear, find the value of m.

Q2 The points $A, B\ and\ C$ have coordinates $(5,4,-3), (4,-6,-10), (1,-36,p)$ respectively.

a) Write down the components of $\overrightarrow{AB}$.

b) $A, B\ and\ C$ are collinear, find the value of p.

Q3 The points $A, B\ and\ C$ have coordinates $(5,1,-4), (0,-7,-6), (r,-39,-14)$ respectively.

a) Write down the components of $\overrightarrow{AB}$.

b) $A, B\ and\ C$ are collinear, find the value of r.

Q4 The points $A, B\ and\ C$ have coordinates $(8,-10,-6), (0,6,4), (-24,f,34)$ respectively.

a) Write down the components of $\overrightarrow{AB}$.

b) $A, B\ and\ C$ are collinear, find the value of f.

Q5 The points $A, B\ and\ C$ have coordinates $(10,3,1), (-5,3,9), (g,3,41)$ respectively.

a) Write down the components of $\overrightarrow{AB}$.

b) $A, B\ and\ C$ are collinear, find the value of g.

Q6 The points $A, B\ and\ C$ have coordinates $(t,6,6), (9,4,-6), (16,2,-18)$ respectively.

a) Write down the components of $\overrightarrow{AB}$.

b) $A, B\ and\ C$ are collinear, find the value of t.

Q7 The points $A, B\ and\ C$ have coordinates $(1,-3,10), (6,2,k), (16,12,-44)$ respectively.

a) Write down the components of $\overrightarrow{AB}$.

b) $A, B\ and\ C$ are collinear, find the value of k.

- EF1.4 Applying geometric skills to vectors:
- Sub-skills
- Determining the resultant of vector pathways in three dimensions
- Working with collinearity

Q8 The points $A, B \text{ and } C$ have coordinates $(-4,2,-4), (-4,4,-3), (-4,1,-5)$ respectively.

a) Write down the components of $\overrightarrow{AB} \text{ and } \overrightarrow{BC}$.

b) Are $A, B \text{ and } C$ collinear?

Q9 The points $A, B \text{ and } C$ have coordinates $(4,-5,2), (-2,5,1), (-20,35,-2)$ respectively.

a) Write down the components of $\overrightarrow{AB} \text{ and } \overrightarrow{BC}$.

b) Are $A, B \text{ and } C$ collinear?

Q10 The points $A, B \text{ and } C$ have coordinates $(-5,2,1), (-8,-6,10), (-17,-30,37)$ respectively.

a) Write down the components of $\overrightarrow{AB} \text{ and } \overrightarrow{BC}$.

b) Are $A, B \text{ and } C$ collinear?

Q11 The points $A, B \text{ and } C$ have coordinates $(3,-4,1), (9,8,10), (27,44,37)$ respectively.

a) Write down the components of $\overrightarrow{AB} \text{ and } \overrightarrow{BC}$.

b) Are $A, B \text{ and } C$ collinear?

Q12 The points $A, B \text{ and } C$ have coordinates $(-2,-2,3), (2,4,1), (6,8,-1)$ respectively.

a) Write down the components of $\overrightarrow{AB} \text{ and } \overrightarrow{BC}$.

b) Are $A, B \text{ and } C$ collinear?

Q13 The points $A, B \text{ and } C$ have coordinates $(1,-5,-4), (-4,0,-2), (-14,10,2)$ respectively.

a) Write down the components of $\overrightarrow{AB} \text{ and } \overrightarrow{BC}$.

b) Are $A, B \text{ and } C$ collinear?

Q14 The points $A, B \text{ and } C$ have coordinates $(3,-5,4), (-4,3,-5), (5,-5,4)$ respectively.

a) Write down the components of $\overrightarrow{AB} \text{ and } \overrightarrow{BC}$.

b) Are $A, B \text{ and } C$ collinear?

- EF1.4 Applying geometric skills to vectors:
- Sub-skills
- Determining the resultant of vector pathways in three dimensions
- Determining the coordinates of an internal division point of a line

Q15 Point B divides $\overrightarrow{AC}$ in a ratio of $1:3$, where A and C are $(2,-5,0),(18,-5,-4)$ respectively.

Find the coordinates of B.

Q16 Point B divides $\overrightarrow{AC}$ in a ratio of $2:1$, where A and B are $(-5,2,1),(-11,-1,16)$ respectively.

Find the coordinates of B.

Q17 Point B divides $\overrightarrow{AC}$ in a ratio of $2:3$, where A and C are $(3,2,2),(23,17,27)$ respectively.

Find the coordinates of B.

Q18 Point B divides $\overrightarrow{AC}$ in a ratio of $3:2$, where A and C are $(-1,-1,-4),(9,-11,-9)$ respectively.

Find the coordinates of B.

Q19 Point B divides $\overrightarrow{AC}$ in a ratio of $3:2$, where A and B are $(4,1,-4),(-11,-2,8)$ respectively.

Find the coordinates of C.

Q20 Point B divides $\overrightarrow{AC}$ in a ratio of $3:1$, where B and C are $(-5,3,3),(-8,3,4)$ respectively.

Find the coordinates of A.

Q21 Point B divides $\overrightarrow{AC}$ in a ratio of $2:3$, where A and B are $(5,-5,4),(9,-3,-2)$ respectively.

Find the coordinates of C.

Q22 Point B divides $\overrightarrow{AC}$ in a ratio of $1:2$, where A and C are $(-5,0,-4),(7,9,-7)$ respectively.

Find the coordinates of B.

Q23 Point B divides $\overrightarrow{AC}$ in a ratio of $2:1$, where B and C are $(11,2,2),(15,5,2)$ respectively.

Find the coordinates of A.

- EF1.4 Applying geometric skills to vectors:
- Sub-skills
- Determining the resultant of vector pathways in three dimensions
- Determining the coordinates of an internal division point of a line

Q24 The points $A, B\ and\ C$ have coordinates $(-5,-5,3), (-10,-1,5), (-25,11,11)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

Q25 The points $A, B\ and\ C$ have coordinates $(-3,2,-3), (-3,17,12), (-3,22,17)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

Q26 The points $A, B\ and\ C$ have coordinates $(4,4,3), (4,4,8), (4,4,18)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

Q27 The points $A, B\ and\ C$ have coordinates $(-1,-2,-5), (5,0,3), (8,1,7)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

Q28 The points $A, B\ and\ C$ have coordinates $(-5,5,5), (-5,6,1), (-5,9,-11)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

Q29 The points $A, B\ and\ C$ have coordinates $(4,-3,-4), (-2,5,-14), (-5,9,-19)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

Q30 The points $A, B\ and\ C$ have coordinates $(-1,-4,4), (-2,-7,6), (-4,13,10)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

Q31 The points $A, B\ and\ C$ have coordinates $(3,3,-2), (5,-5,8), (6,-9,13)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

Q32 The points $A, B\ and\ C$ have coordinates $(-3,-5,-1), (-9,-17,5), (-13,-25,9)$ respectively.

Find the ratio in which B divides $\overrightarrow{AC}$.

- EF1.4 Applying geometric skills to vectors:
- Sub-skills
- Evaluating a scalar product given suitable information and determining the angle between two vectors

Q33 $\overrightarrow{AB} = \begin{pmatrix} 1 \\ -2 \\ -1 \end{pmatrix}, \quad \overrightarrow{AC} = \begin{pmatrix} -5 \\ -1 \\ 2 \end{pmatrix}$

Calculate $\angle BAC$.

Q34 $\overrightarrow{AB} = \begin{pmatrix} 4 \\ -3 \\ 1 \end{pmatrix}, \quad \overrightarrow{AC} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$

$Calculate \ \angle BAC.$

Q35 $\overrightarrow{AB} = \begin{pmatrix} -5 \\ 2 \\ -5 \end{pmatrix}, \quad \overrightarrow{AC} = \begin{pmatrix} -4 \\ -2 \\ 0 \end{pmatrix}$

$Calculate \ \angle BAC.$

Q36 $\overrightarrow{AB} = \begin{pmatrix} -1 \\ 3 \\ 5 \end{pmatrix}, \quad \overrightarrow{AC} = \begin{pmatrix} 3 \\ -1 \\ 1 \end{pmatrix}$

$Calculate \ \angle BAC.$

Q37 $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -3 \\ 2 \end{pmatrix}, \quad \overrightarrow{AC} = \begin{pmatrix} 2 \\ -5 \\ 4 \end{pmatrix}$

$Calculate \ \angle BAC.$

Q38 $\overrightarrow{AB} = \begin{pmatrix} 0 \\ 0 \\ 4 \end{pmatrix}, \quad \overrightarrow{AC} = \begin{pmatrix} 3 \\ 5 \\ 4 \end{pmatrix}$

$Calculate \ \angle BAC.$

Q39 $\overrightarrow{AB} = \begin{pmatrix} -5 \\ 1 \\ 4 \end{pmatrix}, \quad \overrightarrow{AC} = \begin{pmatrix} -4 \\ -5 \\ 5 \end{pmatrix}$

$Calculate \ \angle BAC.$

Q40 $\overrightarrow{AB} = \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix}, \quad \overrightarrow{AC} = \begin{pmatrix} 2 \\ 5 \\ -5 \end{pmatrix}$

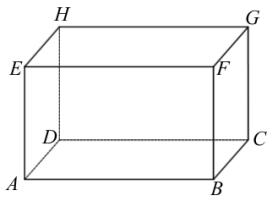
$Calculate \ \angle BAC.$

EF1.4 Applying geometric skills to vectors:

- Sub-skills
- Determining the resultant of vector pathways in three dimensions

Q41 $ABCD, EFGH$ is a cuboid.

$$\overrightarrow{AB} = \begin{pmatrix}3\\1\\2\end{pmatrix},\ \overrightarrow{CB} = \begin{pmatrix}3\\1\\-5\end{pmatrix}\ and\ \overrightarrow{FB} = \begin{pmatrix}-1\\3\\0\end{pmatrix}$$

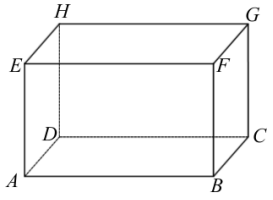


Write down1 the components of :

a) $\overrightarrow{AH}$ **b)** $\overrightarrow{AG}$ **c)** $\overrightarrow{CE}$ **d)** $\overrightarrow{BH}$

Q42 $ABCD, EFGH$ is a cuboid.

$$\overrightarrow{AB} = \begin{pmatrix}-3\\-2\\2\end{pmatrix},\ \overrightarrow{CB} = \begin{pmatrix}2\\-1\\2\end{pmatrix}\ and\ \overrightarrow{DH} = \begin{pmatrix}-2\\10\\7\end{pmatrix}$$

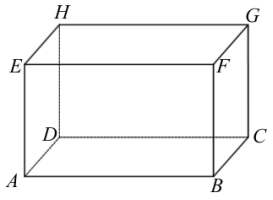


Write down the components of :

a) $\overrightarrow{AH}$ **b)** $\overrightarrow{GA}$ **c)** $\overrightarrow{CE}$ **d)** $\overrightarrow{HB}$

Q43 $ABCD, EFGH$ is a cuboid.

$$\overrightarrow{BA} = \begin{pmatrix}-1\\0\\4\end{pmatrix},\ \overrightarrow{BC} = \begin{pmatrix}8\\5\\2\end{pmatrix}\ and\ \overrightarrow{FB} = \begin{pmatrix}-20\\34\\5\end{pmatrix}$$

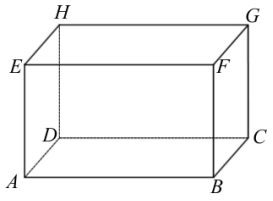


Write down the components of :

a) $\overrightarrow{AH}$ **b)** $\overrightarrow{AG}$ **c)** $\overrightarrow{EC}$ **d)** $\overrightarrow{BH}$

Q44 $ABCD, EFGH$ is a cuboid.

$$\overrightarrow{AB} = \begin{pmatrix}-3\\1\\1\end{pmatrix},\ \overrightarrow{CB} = \begin{pmatrix}2\\1\\5\end{pmatrix}\ and\ \overrightarrow{BF} = \begin{pmatrix}4\\17\\-5\end{pmatrix}$$



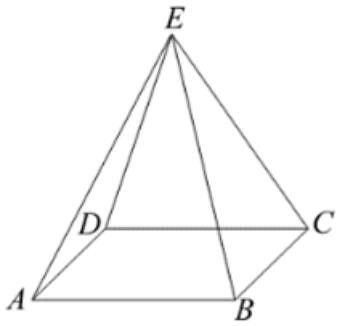
Write down the components of :

a) $\overrightarrow{AC}$ **b)** $\overrightarrow{AG}$ **c)** $\overrightarrow{EC}$ **d)** $\overrightarrow{BH}$

- EF1.4 Applying geometric skills to vectors:
- Sub-skills
- Determining the resultant of vector pathways in three dimensions

Q45 $ABCD, EFGH$ is a rectangular based pyramid.

$\overrightarrow{AB} = \begin{pmatrix} 4 \\ 2 \\ 4 \end{pmatrix}$, $\overrightarrow{CB} = \begin{pmatrix} 4 \\ -4 \\ -2 \end{pmatrix}$ *and* $\overrightarrow{EC} = \begin{pmatrix} 8 \\ 1 \\ -7 \end{pmatrix}$

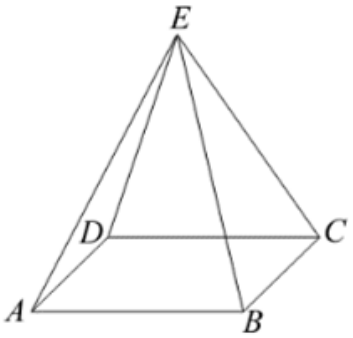


Write down the components of :

a) $\overrightarrow{AC}$ **b)** $\overrightarrow{AE}$ **c)** $\overrightarrow{DE}$ **d)** $\overrightarrow{EB}$

Q46 $ABCD, EFGH$ is a rectangular based pyramid.

$\overrightarrow{BA} = \begin{pmatrix} -4 \\ -6 \\ -2 \end{pmatrix}$, $\overrightarrow{CB} = \begin{pmatrix} 4 \\ -2 \\ -2 \end{pmatrix}$ *and* $\overrightarrow{EC} = \begin{pmatrix} -8 \\ 6 \\ 16 \end{pmatrix}$

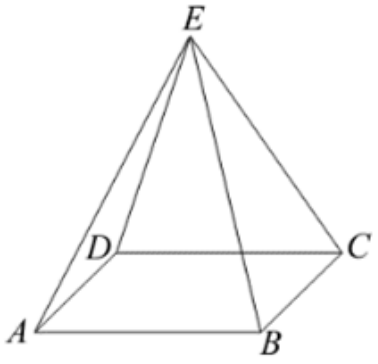


Write down the components of :

a) $\overrightarrow{CA}$ **b)** $\overrightarrow{AE}$ **c)** $\overrightarrow{DE}$ **d)** $\overrightarrow{BE}$

Q47 $ABCD, EFGH$ is a rectangular based pyramid.

$\overrightarrow{AB} = \begin{pmatrix} 4 \\ 4 \\ 8 \end{pmatrix}$, $\overrightarrow{CB} = \begin{pmatrix} -4 \\ -4 \\ 4 \end{pmatrix}$ *and* $\overrightarrow{EC} = \begin{pmatrix} 4 \\ -4 \\ -6 \end{pmatrix}$



Write down the components of :

a) $\overrightarrow{AC}$ **b)** $\overrightarrow{EA}$ **c)** $\overrightarrow{DE}$ **d)** $\overrightarrow{EB}$

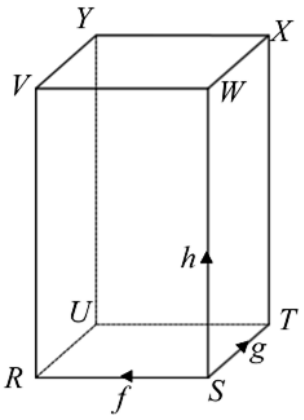
MIXED QUESTIONS

- EF1.4 Applying geometric skills to vectors:
- Sub-skills
- Determining the resultant of vector pathways in three dimensions
- Working with collinearity
- Determining the coordinates of an internal division point of a line
- Evaluating a scalar product given suitable information and determining the angle between two vectors

Q48 In the diagram $RSTU, VWXY$ represents a cuboid.

$\overrightarrow{SR}$ *represents vector* f , $\overrightarrow{ST}$ *represents vector* g *and* $\overrightarrow{SW}$ *represents vector* h.

Express $\overrightarrow{VT}$ in terms of f, g *and* h.



Q49 The diagram shows a cuboid $OPQR, STUV$ relative to the coordinate axes.

P is the point $(4, 0, 0)$, Q *is* $(4, 2, 0)$ *and* U *is* $(4, 2, 3)$.

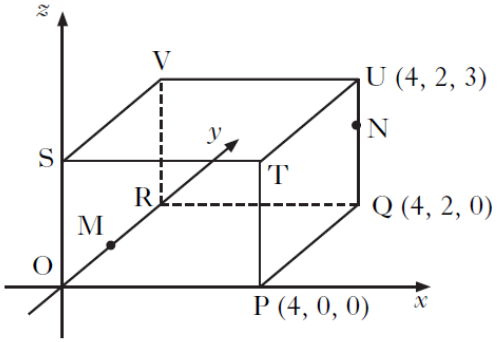
M is the midpoint of OR.

N is the point on UQ such that $UN = \frac{1}{3}UQ$.

a) State the coordinates of M *and* N.

b) Express $\overrightarrow{VM}$ *and* $\overrightarrow{VN}$ in component form.

c) Calculate the size of $\angle MVN$.



Q50 $D, OABC$ is a square based pyramid as shown in the diagram.

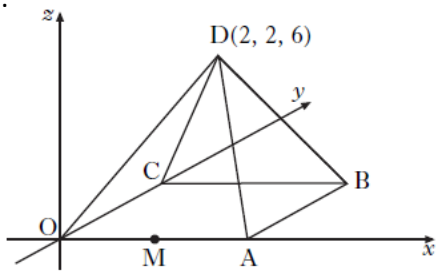
O is the origin, D is the point $(2, 2, 6)$,

M is the mid point of $\overrightarrow{OA}$ and $OA = 4$ *units*.

a) State the coordinates of B.

b) Express $\overrightarrow{DB}$ *and* $\overrightarrow{DM}$ in component form.

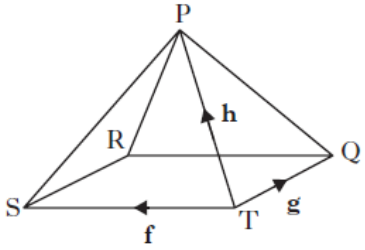
c) Find the size of $\angle BDM$.



Q51 The diagram shows a square based pyramid $P, QRST$.

$\overrightarrow{TS}, \overrightarrow{TQ}$ *and* $\overrightarrow{TP}$ represents f, g *and* h respectively.

Express $\overrightarrow{RP}$ in terms of f, g *and* h .

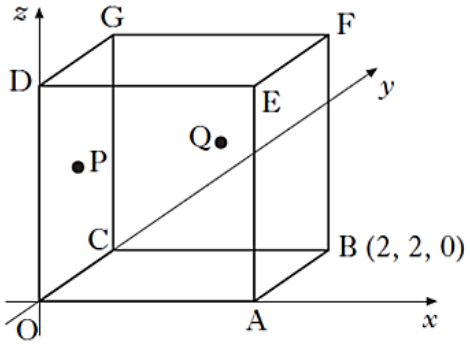


Q52 $OABCDEFG$ is a cube with sides $2\ units$ as shown in the diagram.

B has the coordinates $(2, 2, 0)$.

P is the centre of face $OCGD$.

Q is the centre of Face $CBFG$.



a) Write down the coordinates of G.

b) Find $p\ and\ q$, the position vectors of the points $P\ and\ Q$.

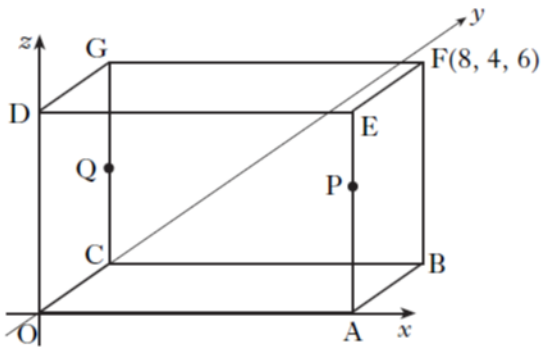
c) Find the size of $\angle POQ$.

Q53 The diagram shows a cuboid $OABC, DEFG$.

F is the point $(8, 4, 6)$.

P divides AE in the ratio $2:1$.

Q is the midpoint of CG.



a) State the coordinates of $P\ and\ Q$.

b) Write down the components of $PQ\ and\ PA$.

c) Find the size of $\angle QPA$.

Q54 VABCD is a pyramid with a rectangular base ABCD.

Relative to some appropriate axes,

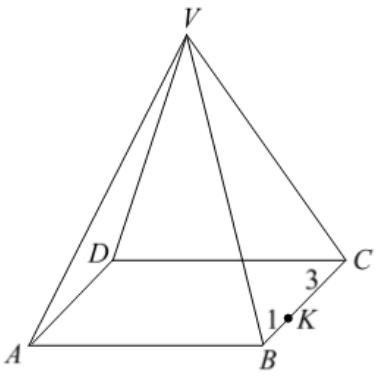
$\overrightarrow{VA}\ represents\ -7i - 13j - 11k$.

$\overrightarrow{AB}\ represents\ 6i + 6j - 6k$.

$\overrightarrow{AD}\ represents\ 8i - 4j + 4k$.

K divides BC in a ratio of $1:3$.

Find $\overrightarrow{VK}$ in component form.

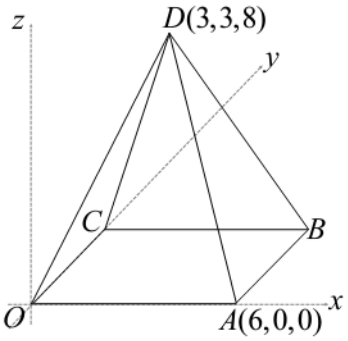


Q55 The diagram shows a square based pyramid of height $8\ units$.

Square OABC has a side length of $6\ units$.

The coordinates of $A\ and\ D$ are $(6,0,0)\ and\ (3,3,8)$.

C lies on the $y\ axis$.



a) Write down the coordinates of B.

b) Determinethe components of $\overrightarrow{DA}\ and\ \overrightarrow{DB}$.

c) Calculate the size of $\angle ADB$.

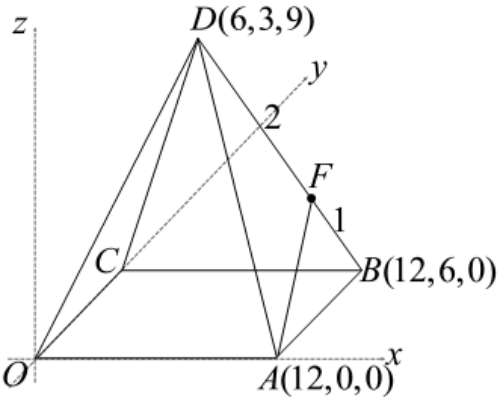
Q56 $D, OABC$ is a pyramid.

A is the point $(12,0,0)$.

B is the point $(12,6,0)$.

D is the point $(6,3,9)$.

F divides BD in a ratio of $1:2$.

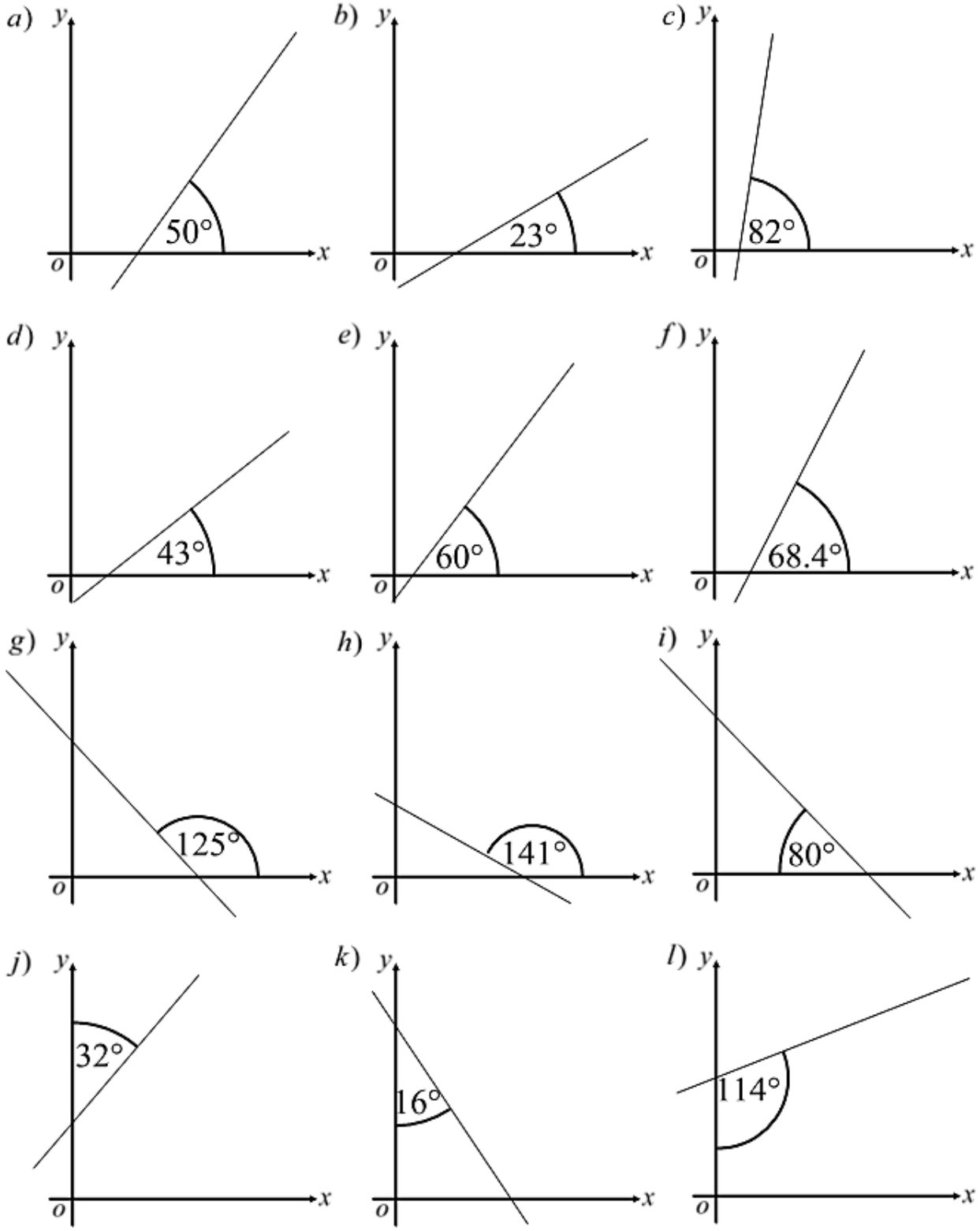


a) Find the coordinates of the point F.

b) Express $\overrightarrow{AF}$ in component form.

- APP1.1 Applying algebraic skills to rectilinear shapes
- Sub-skills
- Using $m = \tan\theta$ to calculate a gradient or angle

Q57 Calculate the gradient of each of the following lines to 3 significant figures.



- APP1.1 Applying algebraic skills to rectilinear shapes
- Sub-skills
- Using $m = \tan\theta$ to calculate a gradient or angle

Q58 For each of the following, calculate the angle the line makes with the positive direction of the $x\ axis$.

a) $y = x - 3$ **b)** $y = 2x + 1$ **c)** $y = 5 - x$

d) $y = -2x + 1$ **e)** $2y - x + 1 = 0$ **f)** $3y + 2 = x$

g) $5x - 2y = 7$ **h)** $2 - 2y - x = 0$ **i)** $\frac{1}{3}y = \frac{1}{4}x + 1$

j) $2(y - 2) = 3(x + 1)$ **k)** $(2 - 3y) = 4x$ **l)** $-2x = \frac{3}{4}y + 1$

- APP1.1 Applying algebraic skills to rectilinear shapes
- Sub-skills
- Finding the equation of a line parallel to, and a line perpendicular to, a given line

Q59 **a)** A line L, has the equation $2x + y - 3 = 0$.

Write down the equation of a line, passing through $(-1,3)$ which is:

i) Parallel to L.

ii) Perpendicular to L.

b) A line L, has the equation $y - 3x + 7 = 0$.

Write down the equation of a line, passing through $(1,1)$ which is:

i) Parallel to L.

ii) Perpendicular to L.

c) A line L, has the equation $2x - 3y - 5 = 0$.

Write down the equation of a line, passing through $(-3,2)$ which is:

i) Parallel to L.

ii) Perpendicular to L.

d) A line L, has the equation $6x + 4y + 2 = 0$.

Write down the equation of a line, passing through $(0,-2)$ which is:

i) Parallel to L.

ii) Perpendicular to L.

e) A line L, has the equation $7y - 4x = 0$.

Write down the equation of a line, passing through $(-4,-2)$ which is:

i) Parallel to L.

ii) Perpendicular to L.

f) A line L, has the equation $\frac{1}{2}x + \frac{1}{3}y - 1 = 0$.

Write down the equation of a line, passing through $(-4,0)$ which is:

i) Parallel to L.

ii) Perpendicular to L.

g) A line L, has the equation $\frac{2}{3}y + x - 3 = 0$.

Write down the equation of a line, passing through $(2,2)$ which is:

i) Parallel to L.

ii) Perpendicular to L.

h) A line L, has the equation $\frac{x+y-4}{2} = 0$.

Write down the equation of a line, passing through $(0,-7)$ which is:

i) Parallel to L.

ii) Perpendicular to L.

Answers.

Q1 a) $\begin{pmatrix}-9\\-14\\-9\end{pmatrix}$ b) $m=-38$

Q2 a) $\begin{pmatrix}-1\\-10\\-7\end{pmatrix}$ b) $p=31$

Q3 a) $\begin{pmatrix}-5\\-8\\-2\end{pmatrix}$ b) $r=-20$

Q4 a) $\begin{pmatrix}-8\\16\\10\end{pmatrix}$ b) $f=54$

Q5 a) $\begin{pmatrix}-15\\0\\8\end{pmatrix}$ b) $g=-75$

Q6 a) $\begin{pmatrix}9-t\\-2\\-12\end{pmatrix}$ b) $t=2$

Q7 a) $\begin{pmatrix}5\\5\\k-10\end{pmatrix}$ b) $k=-8$

Q8 $\overrightarrow{AB}=\begin{pmatrix}0\\2\\1\end{pmatrix}$ $\overrightarrow{BC}=\begin{pmatrix}0\\-3\\-2\end{pmatrix}$ Not collinear

Q9 $\overrightarrow{AB}=\begin{pmatrix}-6\\10\\1\end{pmatrix}$ $\overrightarrow{BC}=3\begin{pmatrix}-6\\10\\-1\end{pmatrix}$ Collinear

Q10 $\overrightarrow{AB}=\begin{pmatrix}-3\\-8\\9\end{pmatrix}$ $\overrightarrow{BC}=3\begin{pmatrix}-3\\-8\\9\end{pmatrix}$ Collinear

Q11 $\overrightarrow{AB}=3\begin{pmatrix}2\\4\\3\end{pmatrix}$ $\overrightarrow{BC}=9\begin{pmatrix}2\\4\\3\end{pmatrix}$ Collinear

Q12 $\overrightarrow{AB}=2\begin{pmatrix}2\\3\\-1\end{pmatrix}$ $\overrightarrow{BC}=2\begin{pmatrix}2\\2\\-1\end{pmatrix}$ Not collinear

Q13 $\overrightarrow{AB}=\begin{pmatrix}-5\\5\\2\end{pmatrix}$ $\overrightarrow{BC}=2\begin{pmatrix}-5\\5\\2\end{pmatrix}$ Collinear

Q14 $\overrightarrow{AB}=\begin{pmatrix}-7\\8\\-9\end{pmatrix}$ $\overrightarrow{BC}=\begin{pmatrix}9\\-8\\9\end{pmatrix}$ Not collinear

Q15 $B(6,-5,-1)$ Q16 $B(-9,0,11)$ Q17 $B(11,8,12)$

Q18 $B(5,-7,-7)$ Q19 $C(-21,-4,16)$ Q20 $A(1,3,1)$

Q21 $C(15,0,-11)$ Q22 $B(-1,3,-5)$ Q23 $A(3,-4,2)$

Q24 $1:3$ Q25 $3:1$ Q26 $1:2$

Q27 $2:1$ Q28 $1:3$ Q29 $2:1$

Q30 $1:2$ Q31 $2:1$ Q32 $3:2$

Q33 $111.880\ldots.°$ Q34 $47.048\ldots.°$ Q35 $60.865\ldots.°$

Q36 $92.921\ldots.°$ Q37 $22.826\ldots.°$ Q38 $55.550\ldots.°$

Q39 $48.335\ldots.°$ Q40 $132.343\ldots.°$

Q41 a) $\overrightarrow{AH} = \begin{pmatrix} -2 \\ -4 \\ 5 \end{pmatrix}$ b) $\overrightarrow{AG} = \begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}$ c) $\overrightarrow{CE} = \begin{pmatrix} 1 \\ -3 \\ -7 \end{pmatrix}$ d) $\overrightarrow{BH} = \begin{pmatrix} 1 \\ -5 \\ 3 \end{pmatrix}$

Q42 a) $\overrightarrow{AH} = \begin{pmatrix} -4 \\ 11 \\ 5 \end{pmatrix}$ b) $\overrightarrow{GA} = \begin{pmatrix} 7 \\ -11 \\ -7 \end{pmatrix}$ c) $\overrightarrow{CE} = \begin{pmatrix} 3 \\ 11 \\ 7 \end{pmatrix}$ d) $\overrightarrow{HB} = \begin{pmatrix} 1 \\ -13 \\ -3 \end{pmatrix}$

Q43 a) $\overrightarrow{AH} = \begin{pmatrix} 28 \\ -29 \\ 7 \end{pmatrix}$ b) $\overrightarrow{AG} = \begin{pmatrix} 29 \\ -29 \\ 3 \end{pmatrix}$ c) $\overrightarrow{EC} = \begin{pmatrix} -11 \\ 39 \\ -7 \end{pmatrix}$ d) $\overrightarrow{BH} = \begin{pmatrix} 27 \\ -29 \\ 11 \end{pmatrix}$

Q44 a) $\overrightarrow{AC} = \begin{pmatrix} -5 \\ 0 \\ -4 \end{pmatrix}$ b) $\overrightarrow{AG} = \begin{pmatrix} -1 \\ 17 \\ -9 \end{pmatrix}$ c) $\overrightarrow{EC} = \begin{pmatrix} -9 \\ -17 \\ 1 \end{pmatrix}$ d) $\overrightarrow{BH} = \begin{pmatrix} 5 \\ 15 \\ -11 \end{pmatrix}$

Q45 a) $\overrightarrow{AC} = \begin{pmatrix} 0 \\ 6 \\ 6 \end{pmatrix}$ b) $\overrightarrow{AE} = \begin{pmatrix} -8 \\ 5 \\ 13 \end{pmatrix}$ c) $\overrightarrow{DE} = \begin{pmatrix} -4 \\ 1 \\ 11 \end{pmatrix}$ d) $\overrightarrow{EB} = \begin{pmatrix} 12 \\ -3 \\ -9 \end{pmatrix}$

Q46 a) $\overrightarrow{CA} = \begin{pmatrix} 0 \\ -8 \\ -4 \end{pmatrix}$ b) $\overrightarrow{AE} = \begin{pmatrix} 8 \\ 2 \\ -12 \end{pmatrix}$ c) $\overrightarrow{DE} = \begin{pmatrix} 12 \\ 0 \\ -14 \end{pmatrix}$ d) $\overrightarrow{BE} = \begin{pmatrix} 4 \\ -4 \\ -14 \end{pmatrix}$

Q47 a) $\overrightarrow{AC} = \begin{pmatrix} 8 \\ 8 \\ 4 \end{pmatrix}$ b) $\overrightarrow{EA} = \begin{pmatrix} -4 \\ -12 \\ -10 \end{pmatrix}$ c) $\overrightarrow{DE} = \begin{pmatrix} 0 \\ 8 \\ 144 \end{pmatrix}$ d) $\overrightarrow{EB} = \begin{pmatrix} 0 \\ -8 \\ -2 \end{pmatrix}$

Q48 $\overrightarrow{VT} = -f - h + g$

Q49 a) $M(0, 1, 0)$ $N(4, 2, 2)$

b) $\overrightarrow{VM} = \begin{pmatrix} 0 \\ -1 \\ -3 \end{pmatrix}$ $\overrightarrow{VN} = \begin{pmatrix} 4 \\ 0 \\ -1 \end{pmatrix}$

c) $\angle MVN = 76.697\ldots°$

Q50 a) $B(4, 4, 0)$

b) $\overrightarrow{DB} = \begin{pmatrix} 2 \\ 2 \\ -6 \end{pmatrix}$ $\overrightarrow{DM} = \begin{pmatrix} 0 \\ -2 \\ -6 \end{pmatrix}$

c) $\angle BDM = 40.290\ldots°$

Q51 $\overrightarrow{RP} = -f - g + h$

Q52 a) $G(0, 2, 2)$

b) $p = \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}$ $q = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$

c) $\angle POQ = 30°$

Q53 a) $P(8, 0, 4)$ $Q(0, 4, 3)$

b) $\overrightarrow{PQ} = \begin{pmatrix} -8 \\ 4 \\ -1 \end{pmatrix}$ $\overrightarrow{PA} = \begin{pmatrix} 0 \\ 0 \\ -4 \end{pmatrix}$

c) $\angle QPA = 83.620 \ldots °$

Q54 $\overrightarrow{VK} = \begin{pmatrix} 1 \\ -8 \\ -16 \end{pmatrix}$

Q55 a) $B(6, 6, 0)$

b) $\overrightarrow{DA} = \begin{pmatrix} 3 \\ -3 \\ -8 \end{pmatrix}$ $\overrightarrow{DB} = \begin{pmatrix} 3 \\ 3 \\ -8 \end{pmatrix}$

c) $\angle ADB = 38.964 \ldots °$

Q56 a) $F(10, 5, 3)$

b) $\overrightarrow{AF} = \begin{pmatrix} -2 \\ 5 \\ 3 \end{pmatrix}$

Q57

a)	$1.191 \ldots$	b)	$0.424 \ldots$	c)	$7.115 \ldots$
d)	$0.932 \ldots$	e)	$\sqrt{3}$ or $1.732 \ldots$	f)	$2.525 \ldots$
g)	$-1.428 \ldots$	h)	$-0.809 \ldots$	i)	$-5.671 \ldots$
j)	$1.600 \ldots$	k)	$-3.487 \ldots$	l)	$0.445 \ldots$

Q58

a)	$45 \ldots °$	b)	$63.434 \ldots °$	c)	$135 \ldots °$
d)	$116.56 \ldots °$	e)	$26.565 \ldots °$	f)	$18.434 \ldots °$
g)	$68.198 \ldots °$	h)	$153.434 \ldots °$	i)	$36.869 \ldots °$
j)	$56.309 \ldots °$	k)	$126.869 \ldots °$	l)	$110.556 \ldots °$

Q59 a) i) $y - 3 = -2(x + 1)$

ii) $y - 3 = \frac{1}{2}(x + 1)$

b) i) $y - 1 = 3(x - 1)$

ii) $y - 1 = -\frac{1}{3}(x - 1)$

c) i) $y - 2 = \frac{2}{3}(x + 3)$

ii) $y - 2 = -\frac{3}{2}(x + 3)$

d) i) $y + 2 = -\frac{3}{2}x$

ii) $y + 2 = \frac{2}{3}x$

e) i) $y + 2 = \frac{4}{7}(x + 4)$

ii) $y + 2 = -\frac{7}{4}(x + 4)$

f) i) $y = -\frac{3}{2}(x + 4)$

ii) $y = \frac{2}{3}(x + 4)$

g) i) $y - 2 = -\frac{3}{2}(x - 2)$

ii) $y - 2 = \frac{2}{3}(x - 2)$

h) i) $y + 7 = -x$

ii) $y + 7 = x$