

4.1 Coordinates, distance and midpoint formula in 2D and 3D

- 1** A treasure has been hidden somewhere in the forest. Find its 3D position using the following instructions.
- a** To situate the starting point, find the right angle triangle ABC among the following option and state the coordinate where it happens:
- | | |
|---|---|
| 1 $A(3,0) B(4,0) C(1,2)$ | 2 $A(-6,-2) B(-4,3) C(-2,8)$ |
| 3 $A(-2,1) B(1,-2) C(3,0)$ | 4 $A(-2,-2\sqrt{3}) B(4,0) C(-2,2\sqrt{3})$ |
| 5 $A(1,-\sqrt{2}) B(1,\sqrt{2}) C(1+\sqrt{5},0)$ | 6 $A(\sqrt{7},4) B(2\sqrt{7},2) C(\sqrt{7},2)$ |
- i** Find AB, BC, AC for each
- ii** State whether there are equilateral, isosceles or scalene
- iii** State whether any of $\angle ABC$, $\angle BAC$ and $\angle CAB$ is a right angle
- iv** State the coordinate of the vertex of 90° angle
- b** then calculate
- i** the coordinate of D such that D on AD = $\frac{1}{3}$ AC
- ii** the coordinate of E the midpoint of DB
- iii** the coordinate of F (a, -3.5) such that EF will be 5 units apart.
- iv** the coordinate of G such that ABCG form a rectangle
- v** the coordinate of H such that HGC is isosceles and H is $\sqrt{29}$ units away from A
- vi** the coordinate of I such as F is the midpoint of HI
- c** Now let's raise above the floor and find
- i** the distance between I whose z coordinate is 0 and $(-2,4,12)$
- ii** the coordinate of J the midpoint between I and $(-4,8,12)$
- iii** The coordinate of the point K such as K is in the form $(5,-a, 3a)$ and $JK = 13$
- iv** The coordinate of the point L such that KL is the diameter of a sphere of radius 13 center J.
- v** The coordinates of the point M such that MZLK is a parallelogram and $Z = (3,0,-6)$
- vi** The coordinates of the point N such that NYKM is a square and $Y = (7,-2,18)$
- vii** The coordinate of the point O the position of the treasure which is the midpoint of NL

Extension: challenge yourself and find the coordinates of the cube KMNYSR such that the face OPQR and thus the vertices O,P,Q and R and further away from J than the face KMNY

Answers

1 a i,ii,iii

triangle	AB	BC	AC		
1	1	$\sqrt{6}$	$2\sqrt{2}$		
2	$\sqrt{29}$	$2\sqrt{29}$	$\sqrt{29}$	Straight line	
3	$\sqrt{18}$	$\sqrt{26}$	$\sqrt{8}$	Right angles	\angle BAC
4	$\sqrt{48} = 4\sqrt{3}$	$\sqrt{48}$	$\sqrt{48}$	equilateral	
5	$2\sqrt{2}$	$\sqrt{7}$	$2\sqrt{2}$	isoceles	
6	$\sqrt{11}$	$\sqrt{7}$	2		

iv the starting point is $A(-2,1)$

b i $D = (0,-1)$ ii $E = (1.5,-0.5)$ iii $5^2 - (-3.5)^2 = a^2$ so $F = (5.5,-3.5)$

iv $G = (-2 + 2, 1 + 2) = (0,3)$ v $H = (3,3,0)$

vi $I = (8,-10)$

c i $2\sqrt{110}$ ii $J = (2,-2,6)$ iii $K = (5,-6,18)$ iv $L = (-1,2,-6)$

v $M = (9,-8,18)$ vi $N = (11,-4, 18)$ vii $O = (5,-1,6)$

Extension:

S = $(7,-2,\sqrt{505})$, P = $(5,-6,\sqrt{505})$, Q = $(9,-8,\sqrt{505})$ and R = $(11,-4,\sqrt{505})$