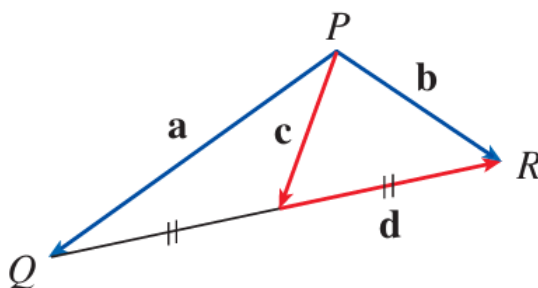


1. Find the lengths of the sides of the triangle  $PQR$ . Is it a right triangle? Is it an isosceles triangle?
  - (a)  $P(3, -2, -3), Q(7, 0, 1), R(1, 2, 1)$
  - (b)  $P(2, -1, 0), Q(4, 1, 1), R(4, -5, 4)$
2. In the figure, the tip of  $\mathbf{c}$  and the tail of  $\mathbf{d}$  are both the midpoint of  $QR$ . Express  $\mathbf{c}$  and  $\mathbf{d}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$



3. Find the direction cosines and direction angles of the vector. (keep anti-trigonometric function in results)
  - (a)  $\langle 4, 1, 8 \rangle$
  - (b)  $3\mathbf{i} - \mathbf{j} - 2\mathbf{k}$
  - (c)  $\langle c, c, c \rangle$ , where  $c > 0$

1. (a)  $|PQ| = 6$   
 $|QR| = 2\sqrt{10}$   
 $|RP| = 6$   
 $PQR$  is not a right triangle.  
 $PQR$  is isosceles.

- (b)  $|PQ| = 3$   
 $|QR| = 3\sqrt{5}$   
 $|RP| = 6$   
 $PQR$  is a right triangle.  
 $PQR$  is not isosceles.

2.

$$\mathbf{c} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$$

$$\mathbf{d} = -\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$$

3. (a)  $|\langle 4, 1, 8 \rangle| = 9$ , we have  $\cos \alpha = \frac{4}{9}, \cos \beta = \frac{1}{9}, \cos \gamma = \frac{8}{9}$ . The direction angles are given by  $\alpha = \arccos \frac{4}{9}, \beta = \arccos \frac{1}{9}, \gamma = \arccos \frac{8}{9}$
- (b)  $|3\mathbf{i} - \mathbf{j} - 2\mathbf{k}| = \sqrt{14}$ , we have  $\cos \alpha = \frac{3}{\sqrt{14}}, \cos \beta = -\frac{1}{\sqrt{14}}, \cos \gamma = -\frac{2}{\sqrt{14}}$ . The direction angles are given by  $\alpha = \arccos \frac{3}{\sqrt{14}}, \beta = \arccos \left(-\frac{1}{\sqrt{14}}\right), \gamma = \arccos \left(-\frac{2}{\sqrt{14}}\right)$
- (c)  $|\langle c, c, c \rangle| = \sqrt{3}c$ , we have  $\cos \alpha = \cos \beta = \cos \gamma = \frac{1}{\sqrt{3}}$ . The direction angles are given by  $\alpha = \beta = \gamma = \arccos \frac{1}{\sqrt{3}}$