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(1) a) $6i^\circ - 8j$

$$|v| = \sqrt{6^2 + (-8)^2}$$
$$= 10.$$

b) $5i + 4j$

$$|v| = \sqrt{5^2 + 4^2}$$
$$= \sqrt{41}$$

c) $-3i^\circ + 6j^\circ$

$$|v| = \sqrt{(-3)^2 + 6^2}$$
$$= 3\sqrt{5}.$$

d) $-8i - 8j^\circ$

$$|v| = \sqrt{(-8)^2 + (-8)^2}$$
$$= 8\sqrt{2}.$$

(2) a) $2i^\circ + 4j^\circ$

$$\theta = \tan^{-1}\left(\frac{4}{2}\right)$$
$$\theta = \tan^{-1}(2)$$
$$\theta \approx 63.4^\circ$$

b) $-7i - j$

$$\theta = \tan^{-1}\left(\frac{-1}{-7}\right)$$
$$\theta = \tan^{-1}(1/7)$$
$$\theta \approx 8.1$$

(the vector is in Quadrant 3, so we add/subtract 180)

$$\theta = 180^\circ - 8.1^\circ$$
$$= 171.9^\circ.$$

c) $6j^\circ = 0i^\circ + 6j^\circ$

$$\theta = 90^\circ$$

d) $5i^\circ - 5j^\circ$

$$\theta = \tan^{-1}\left(\frac{-5}{5}\right)$$
$$= \tan^{-1}(-1) \qquad \theta = 45^\circ$$

As the vector is in Quadrant 4, the answer has to be $\theta = 45^\circ$ below axis.

(3) find the unit vector in the direction $-5i + 12j$

$u = \frac{v}{|v|}$

$v = -5i + 12j$

$|v| = \sqrt{(-5)^2 + 12^2}$

$= 13.$

$u = \left(\frac{-5}{13}\right)i + \left(\frac{12}{13}\right)j$

$u = -\frac{5}{13}i + \frac{12}{13}j.$

(4) $p \Rightarrow 50\cos 45° = 50 \times \frac{\sqrt{2}}{2}$

$= 25\sqrt{2}$

$q = 50\sin 45° = 50 \times \frac{\sqrt{2}}{2}$

$= 25\sqrt{2}$

the vector - positive x direction & negative y direction

$r = 25\sqrt{2}i - 25\sqrt{2}j$

(5) $|a| = 11 \rightarrow 11 = \frac{\sqrt{p^2+q^2}}{\sqrt{p^2+q^2}}$

$|2| =$

$p = 11\cos 20$
$= 11 \times 0.9397$
$= 10.3$

$q = 11\sin 20$
$= 11 \times 0.3420$
$= 3.76$

$p = 10.3$
$q = 3.76.$

(6) $2|p| + 3|q| = \sqrt{13}$

$\sqrt{p^2+q^2} = 7$

$p^2 + q^2 = 49$

$q^2 = 49 - p^2$

$|q| = \sqrt{49-p^2}$

$2|p| + 3\sqrt{49-p^2} = \sqrt{13}$

$3\sqrt{49-p^2} = \sqrt{13} - 2|p|$

$9(49-p^2) = (\sqrt{13} - 2|p|)^2$

$441 - 9p^2 = 13 - 4\sqrt{13}|p| + 4p^2$

Q6 continued:

$441 - 13 = 9p^2 + 4p^2 - 4\sqrt{13}|p|$

$428 = 13p^2 - 4\sqrt{13}|p|$

$428 = 13p^2 - 4(3.605)|p|$

$p = \pm 7$.

(7) a) $\vec{OA} = 5i + 4j$, $\vec{AB} = 7i - 4j$. $\vec{CB} = 10i + 7j$

$\vec{OB} = \vec{OA} + \vec{AB}$

$= (5i + 4j) + (7i - 4j)$

$= 12i + 0j$

$\cos\theta = \frac{a \times b}{|a||b|}$

b) $\vec{OC} = \vec{OB} + \vec{CB}$

$= 12i + 10i + 7j$

$= 22i + 10i$

c) $\angle AOB = 38.7$

a) $\vec{OA} \times \vec{OB} = (5 \times 12) + (4 \times 0)$

$= 60$

$|\vec{OA}| = \sqrt{5^2 + 4^2}$

$= \sqrt{41}$

$|\vec{OB}| = \sqrt{12^2 + 0^2}$

$= \sqrt{144} = 12$

$\cos\theta = \frac{60}{\sqrt{41} \times 12}$

$\theta = 38.7°$

d) $\angle BOC$

$\vec{OB} \times \vec{OC} = (12 \times 22) + (0 \times 7)$

$= 264$

$\vec{OB} = 12$

$\vec{OC} = \sqrt{22^2 + 7^2}$

$= \sqrt{533}$

$\cos\theta = \frac{264}{12 \times \sqrt{533}}$

$\theta = 74.1°$

$\angle AOC = \angle AOB + \angle BOC$

$= 38.7° + 74.1°$

$= 112.7°$

Final Answers:

$\angle AOB = 38.7°$

$\angle BOC = ~~74.1~~ 74.1°$

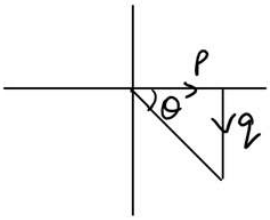
$\angle AOC = 112.7°$

8) $\sqrt{p^2+q^2} = 6.5$

$p^2+q^2 = 42.25$

$\tan\theta = -\frac{5}{12} = \frac{q}{p}$ ← opp, ↖ adj

$\Rightarrow q = -\frac{5}{12}p$



Substitute into $p^2+q^2 = 42.25$

$p^2 + \left(-\frac{5}{12}p\right)^2 = 42.25$

$p^2 + \frac{25}{144}p^2 = 42.25$

$p^2\left(1+\frac{25}{144}\right) = 42.25$

$p^2\left(\frac{169}{144}\right) = 42.25$

$p^2 = 42.25 \times \frac{144}{169}$

$p^2 = 36$

$p = -\sqrt{36}^{+}$

$= \pm 6$

Using $q = \frac{-5}{12}p$

$q = \frac{-5}{12} \times (\pm 6)$

$q = \pm 2.5$.