

Write $\vec{d} = \langle 5, 1 \rangle$ as the sum of 2 vectors, one perpendicular to $\vec{g} = \langle -6, 4 \rangle$ and one parallel to $\vec{g}$.

SCORE: ____ / 6 PTS

$$\text{PROJ}_{\vec{g}} \vec{d} = \frac{\vec{d} \cdot \vec{g}}{\vec{g} \cdot \vec{g}} \vec{g} = \frac{5(-6) + 1(4)}{(-6)^2 + 4^2} \langle -6, 4 \rangle$$

$$\begin{aligned} &= \frac{1}{2} \cdot \frac{-26}{52} \langle -6, 4 \rangle \\ &= \frac{1}{2} \cdot \frac{-1}{2} \langle -6, 4 \rangle \end{aligned}$$

$$= \langle 3, -2 \rangle \textcircled{1}$$

$$\langle 5, 1 \rangle - \langle 3, -2 \rangle = \langle 2, 3 \rangle \textcircled{1}$$

$$\langle 5, 1 \rangle = \langle 3, -2 \rangle + \langle 2, 3 \rangle \textcircled{1}$$

[FILL IN THE BLANKS]

SCORE: ____ / 7 PTS

$$(x+1)^2 + (-4)^2 + (z-9)^2 = 19$$

[a] The equation of the xz - trace of the sphere $(x+1)^2 + (y-4)^2 + (z-9)^2 = 19$ is $(x+1)^2 + (z-9)^2 = 3$.

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[b] If $\vec{b} \cdot \vec{a} = -9$, then the angle between $\vec{a}$ and $\vec{b}$ is OBTUSE. (NOTE: The answer is one word.)

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[c] You start at the origin in 3D, and move 6 units right, 8 units down, and 4 units backward. You are now at the point with

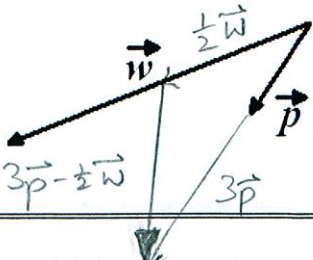
co-ordinates $(-4, 6, -8)$, you are in octant 6, and you are 4 units away from the yz - plane. ② IF ALL 3 COORDINATES CORRECT, ① IF 2 COORDINATES CORRECT

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For the vectors shown below, sketch the vector $3\vec{p} - \frac{1}{2}\vec{w}$.

SCORE: ____ / 3 PTS



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If $\vec{a} = \langle 3, -2, 4 \rangle$ is perpendicular to $\vec{b} = \langle c, 5, 6 \rangle$, find the value of c .

SCORE: ____ / 3 PTS

$$\vec{a} \cdot \vec{b} = 0$$

$$3(c) - 2(5) + 4(6) = 0$$

$$3c = -14$$

$$c = -\frac{14}{3}$$

Let $\vec{s} = -\vec{i} + 7\vec{k}$.

SCORE: ____ / 11 PTS

- [a] Find a vector $\vec{t}$, with magnitude of 6, in the opposite direction as $\vec{s}$.
Write your answer in component form (ie. using angle bracket notation.)

$$\begin{aligned} -6 \left(\frac{1}{\|\vec{s}\|} \right) \vec{s} &= \frac{-6}{\sqrt{(-1)^2 + 7^2}} \langle -1, 0, 7 \rangle \\ &= \frac{-6}{5\sqrt{2}} \langle -1, 0, 7 \rangle \quad \rightarrow \quad = -\frac{3\sqrt{2}}{5} \langle -1, 0, 7 \rangle \\ &= \left\langle \frac{3\sqrt{2}}{5}, 0, -\frac{21\sqrt{2}}{5} \right\rangle \end{aligned}$$

- [b] If $\vec{s}$ represents a force that moves an object from $T = (2, 3, -8)$ to $M = (-1, -5, -6)$, find the work done.

$$\begin{aligned} \vec{s} \cdot \overrightarrow{TM} &= \vec{s} \cdot \langle -1-2, -5-3, -6-(-8) \rangle \\ &= \langle -1, 0, 7 \rangle \cdot \langle -3, -8, 2 \rangle \\ &= (-1)(-3) + 0(-8) + 7(2) \\ &= 17 \end{aligned}$$

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- [c] If $\vec{q}$ is a vector of magnitude 3 such that $\vec{q}$ makes a 120° angle with $\vec{s}$, find $\vec{q} \cdot \vec{s}$.

$$\begin{aligned} \vec{q} \cdot \vec{s} &= \|\vec{q}\| \|\vec{s}\| \cos 120^\circ \\ &= 3 \cdot 5\sqrt{2} \cdot \left(-\frac{1}{2}\right) \\ &= -\frac{15\sqrt{2}}{2} \end{aligned}$$

- [d] Find the angle between $\vec{c} = \langle -3, 0, -4 \rangle$ and $\vec{s}$.

$$\begin{aligned} \cos^{-1} \frac{\vec{c} \cdot \vec{s}}{\|\vec{c}\| \|\vec{s}\|} &= \cos^{-1} \frac{(-3)(-1) + 0 + (-4)(7)}{\sqrt{(-3)^2 + (-4)^2} \cdot 5\sqrt{2}} \\ &= \cos^{-1} \frac{25}{25\sqrt{2}} = \cos^{-1} \frac{1}{\sqrt{2}} = \cos^{-1} \cdot \frac{\sqrt{2}}{2} = 45^\circ \text{ or } \frac{\pi}{4} \end{aligned}$$