

Key

## Quiz 2

This is a two-stage quiz. During the first stage, use your knowledge & calculator. You have 15 min. In the second stage, you are now welcome to use your books, notes, and students in the class to retake the same quiz. You have the remainder of the quiz time to write one solution (with everyone's name on it!!!) to be turned in for the group.

1. Let  $\vec{v} = \vec{i} - 4\vec{j} + \vec{k}$  and  $\vec{w} = \langle -3, 1, 5 \rangle$ .

(a) [2] Determine if  $\vec{v}$  and  $\vec{w}$  are parallel, perpendicular or neither.

ie. find angle between  $\vec{v}$  and  $\vec{w}$ , use  $\vec{v} \cdot \vec{w} = \|\vec{v}\| \cdot \|\vec{w}\| \cos \theta$  (+.5)

$$\vec{v} = \vec{i} - 4\vec{j} + \vec{k} \quad \text{so } \vec{v} \cdot \vec{w} = \langle 1, -4, 1 \rangle \cdot \langle -3, 1, 5 \rangle = 1(-3) - 4(1) + 1(5) = -3 - 4 + 5 = -2$$

$$\|\vec{v}\| = \sqrt{1^2 + (-4)^2 + 1^2} = \sqrt{18} = 3\sqrt{2}$$

$$\|\vec{w}\| = \sqrt{(-3)^2 + 1^2 + 5^2} = \sqrt{35}$$

$$\cos \theta = \frac{-2}{3\sqrt{2} \cdot \sqrt{35}} \Rightarrow \theta \neq 0 \text{ or } 180 \text{ or } 90 \text{ or } 270 \text{ or } 0$$

Neither (+.5)

(b) [2] Write down an equation of a line that passes through  $P(1, 2, -1)$  and is parallel to  $\vec{w}$ . LOTS of answers for this? equation of a line (+.5)

Lines + Planes #1

$$\langle x, y, z \rangle = \langle 1, 2, -1 \rangle + t \langle -3, 1, 5 \rangle$$

$$\langle x, y, z \rangle = \langle 1, 2, -1 \rangle + t \langle -3, 1, 5 \rangle$$

as  $t$  varies through all real #'s

OR

$$\begin{cases} x = 1 - 3t \\ y = 2 + t \\ z = -1 + 5t \end{cases}$$

OR

$$\frac{x-1}{-3} = t = \frac{y-2}{1} = \frac{z+1}{5}$$

$$\frac{x-1}{-3} = \frac{y-2}{1} = \frac{z+1}{5}$$

(c) [2] Write down an equation of a plane that passes through  $P(1, 2, -1)$  and is perpendicular to  $\vec{w}$ . LOTS of answers for this? equation of a plane (+.5)

Web #123 #4

$$0 = \vec{w} \cdot (\langle x, y, z \rangle - \langle 1, 2, -1 \rangle)$$

$$0 = \langle -3, 1, 5 \rangle \cdot \langle x-1, y-2, z+1 \rangle$$

$$0 = -3(x-1) + (y-2) + 5(z+1)$$

$$0 = -3x + 3 + y - 2 + 5z + 5$$

$$3x - y - 5z = 6$$

2. A bicycle pedal is pushed by a foot with 60 Newton force as shown. The shaft of the pedal is .24 m long.

(a) [1] Identify the direction of the torque.

$\vec{\tau} = \vec{r} \times \vec{F}$  so up out of the page (+.5)

(b) [3] Find the magnitude of the torque.

Web #124 #5

$$\|\vec{\tau}\| = \|\vec{r}\| \cdot \|\vec{F}\| \sin \theta$$

$$= .25 \text{ m} \cdot 60 \text{ N} \cdot \sin 80^\circ$$

$$\approx 14.2$$

