

As a reminder, you are welcome to use a non-internet accessing calculator (which includes Desmos Test Mode) but no books, other notes, or peers. Show your work for the following problems. The correct answer with no supporting work will receive NO credit.

1. [6] TRUE/FALSE: Write True in each of the following cases if the statement is *always* true and provide a brief justification. Otherwise, write False and provide a counterexample or brief justification.

(a) (3DActivity#2) A vector values function that describes the intersection of the paraboloid $z = 7x^2 + y^2$ and the parabolic cylinder $y = 3x^2$ is $\langle t, 3t^2, 7t^2 + 9t^4 \rangle$.

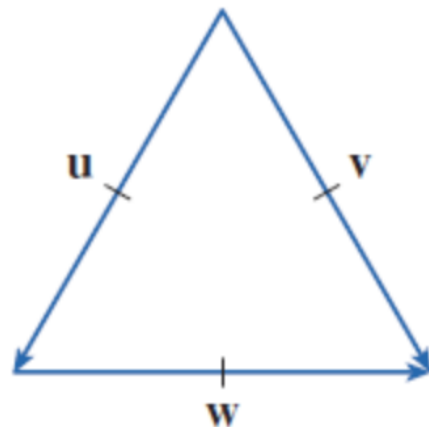
(b) (§13.2#26) If $\vec{r}(t) = \langle \ln(t+1), t \cos(2t), 2^t \rangle$, then the line tangent to $\vec{r}(0)$ is:

$$\langle x, y, z \rangle = \langle 0, 0, 1 \rangle + s \left\langle \frac{1}{t+1}, -2t \sin(2t) + \cos(2t), 2^t (\ln 2) \right\rangle$$

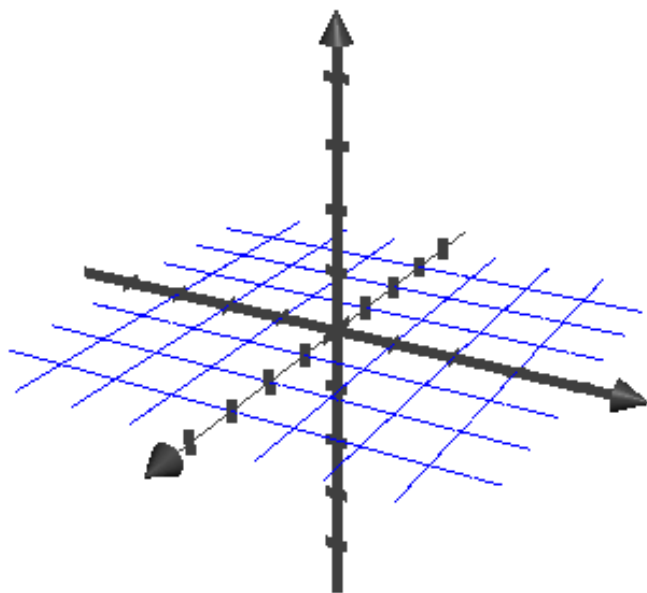
2. Let $\vec{u}$, $\vec{v}$, and $\vec{w}$ be the vectors shown on the right with $3 = \|\vec{u}\| = \|\vec{v}\| = \|\vec{w}\|$.

(a) [2] (WebHW12.3#5) Find $\vec{u} \cdot \vec{w}$

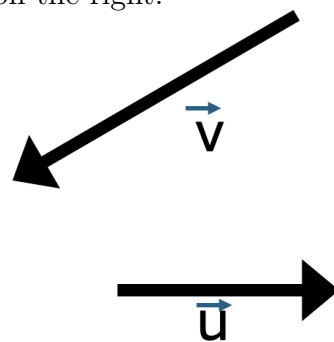
(b) [2] (Quiz2#3) Find $\vec{u} \times \vec{w}$



3. [3] (VectorActivity#1) Label the axis, plot $4x + 2y + 6z = 12$, and clearly label one point.



4. [3] (WrittenHW12.2 #6) Let $\vec{u}$ and $\vec{v}$ be the vectors shown on the right. Sketch $2\vec{u} - \vec{v}$



5. Use the following information below for the following questions.

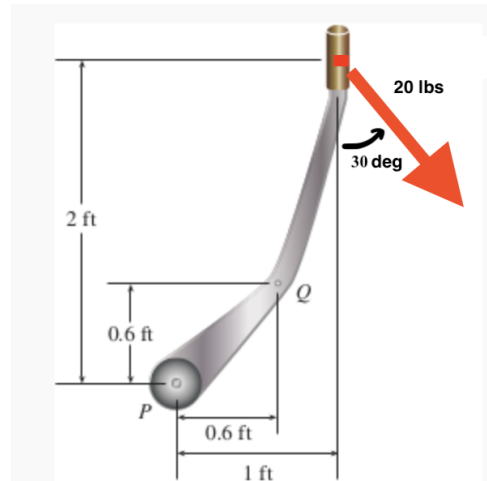
- The object A is given by $\langle 1, 2, 0 \rangle + \langle -3, 1, 4 \rangle t$ where t is a real number.
- Let the point $Q \in \mathbb{R}^3$ satisfy the equation of A .
- Let P be another point such that $\|\vec{PQ}\| = \sqrt{30}$,
- the angle between $\langle -3, 1, 4 \rangle$ and $\vec{PQ}$ is $\frac{\pi}{6}$ radians.

(a) [1] (Quiz2#2) Identify if A is a line, a plane, or some other 3D object.

(b) [3] (Lines&PlanesActivity#4) Find the distance between the point P and A . Consider drawing a picture to more easily show your work.

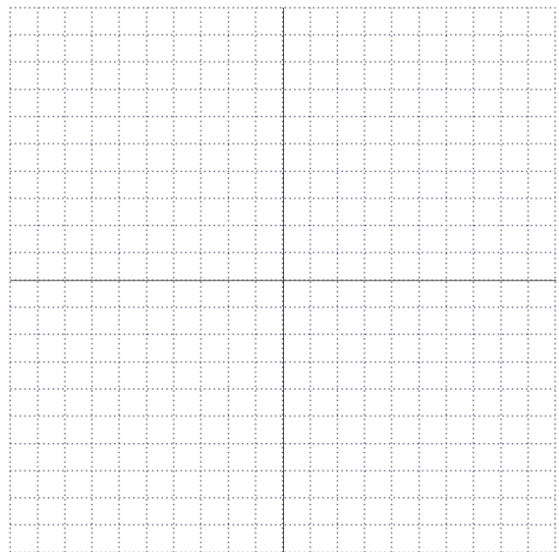
6. (WrittenHW12.4 #40) Consider the bicycle pedal shown on the right. A force of 20 lbs is applied at an angle as shown in the same plane as the gearing.

- (a) [3] Draw a set of axis and write the components of the force vector with respect to your axis.
- (b) [2] Find the *vector* of the torque created about the pivot point P .



7. (WordProblem #2) A plane is flying at 120 knots and there is a wind with a speed of 25 knots in the direction of 120° from due east.

- (a) [2] If the pilot steers the plane directly due east, approximately what direction will the plane flight take? Briefly justify your answer.
- (b) [3] What angle from due east does the pilot need to steer the plane so that the resulting flight path is due east?



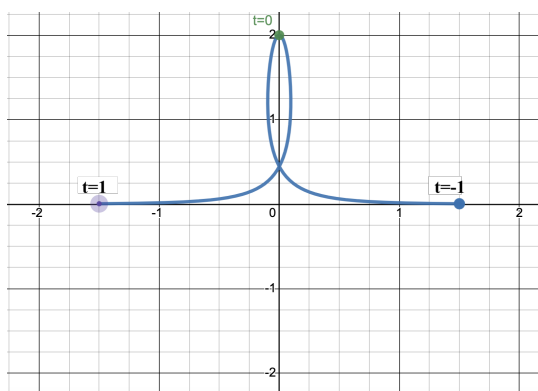
8. [4] (WebHW10.2#3) Given the following information, find the line tangent to the curve $x = f(t)$, $y = g(t)$ when $t = \frac{1}{2}$. Use whatever form of a line you like (eg. parametric, slope-intercept, standard, etc)

$$f\left(\frac{1}{2}\right) = 3.2 \quad g\left(\frac{1}{2}\right) = -1.5 \quad \frac{df}{dt}\left(\frac{1}{2}\right) = 2.8 \quad \frac{dg}{dt}\left(\frac{1}{2}\right) = 1$$

9. (PracticeExam1#4) Consider the parametric curve $x = f(t)$, $y = g(t)$ where $-1 \leq t \leq 1$, graphed below for the following questions.

- (a) [1] (WebHW13.1#1)

Note the t values recorded on the graph. Indicate the direction of which t increases with an arrow on the graph.



- (b) [1] Looking at the graph, approximate where $\frac{dy}{dx}$ is not defined. (Report either a point on the graph or an approximate t value.)

- (c) [4] Sketch the equations $x = f(t)$ and $y = g(t)$ on the pair of axis below.

