

**2.1: 4, 7, 9, 12, 14, 17, 26, 30, 32, 38, 40, 46**

4.  $\vec{RP}$

$$\begin{aligned} &\text{Given: } R(-3,7) \text{ and } P(-1,3) \\ &\vec{RP} = \langle -1 - (-3), 3 - 7 \rangle = \boxed{\text{a. } \langle 2, -4 \rangle} = \boxed{\text{b. } 2\hat{\mathbf{i}} - 4\hat{\mathbf{j}}} \end{aligned}$$

7.  $2\vec{PQ} - 2\vec{PR}$

$$\begin{aligned} &\text{Given: } R(-3,7), P(-1,3), \text{ and } Q(1,5) \\ &2\vec{PQ} - 2\vec{PR} = 2\langle 1 - (-1), 5 - 3 \rangle - 2\langle -3 - (-1), 7 - 3 \rangle \\ &= 2\langle 2, 2 \rangle - 2\langle -2, 4 \rangle = \langle 4, 4 \rangle - \langle -4, 8 \rangle = \\ &= \boxed{\text{a. } \langle 8, -4 \rangle} = \boxed{\text{b. } 8\hat{\mathbf{i}} - 4\hat{\mathbf{j}}} \end{aligned}$$

9. The unit vector in the direction of  $\vec{PQ}$

$$\begin{aligned} &\text{As found: } \vec{PQ} = \langle 2, 2 \rangle \\ &\text{UV of } \vec{PQ} = \frac{\langle 2, 2 \rangle}{\|\vec{PQ}\|} \\ &\frac{\langle 2, 2 \rangle}{\sqrt{2^2 + 2^2}} = \frac{\langle 2, 2 \rangle}{2\sqrt{2}} = \left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle = \left\langle \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right\rangle = \boxed{\frac{\sqrt{2}}{2}\hat{\mathbf{i}} + \frac{\sqrt{2}}{2}\hat{\mathbf{j}}} \end{aligned}$$

12. A vector  $\mathbf{v}$  has initial point  $(-2, 5)$  and terminal point  $(3, -1)$ . Find the unit vector in the direction of  $\mathbf{v}$ . Express the answer in component form.

$$\begin{aligned} &\text{Given: } \vec{v} = \langle 3 - (-2), -1 - 5 \rangle = \langle 5, -6 \rangle \\ &\text{UV of } \vec{v} = \frac{\vec{v}}{\|\vec{v}\|} \\ &\frac{\langle 5, -6 \rangle}{\sqrt{5^2 + (-6)^2}} = \frac{\langle 5, -6 \rangle}{\sqrt{25 + 36}} = \frac{\langle 5, -6 \rangle}{\sqrt{61}} = \boxed{\left\langle \frac{5}{\sqrt{61}}, -\frac{6}{\sqrt{61}} \right\rangle} \end{aligned}$$

14. The vector  $\mathbf{v}$  has initial point  $P(1, 1)$  and terminal point  $Q$  that is on the x-axis and left of the initial point. Find the coordinates of terminal point  $Q$  such that the magnitude of the vector  $\mathbf{v}$  is 10.

$$\begin{aligned} &\text{Given: } P(1, 1), Q(q_x, 0), \text{ and } \|\vec{P, Q}\| = 10 \\ &\text{Note that: } q_x < 1 \\ &(q_x - 1)^2 + (0 - 1)^2 = 10 \\ &(q_x - 1)^2 + 1 = 10 \\ &(q_x - 1)^2 = 9 \\ &q_x = \pm\sqrt{9} + 1 \\ &q_x = 1 - 3 = -2 \\ &\boxed{Q = (-2, 0)} \end{aligned}$$

17. Let  $\mathbf{a}$  be a standard-position vector with terminal point  $(-2, -4)$ . Let  $\mathbf{b}$  be a vector with initial point  $(1, 2)$  and terminal point  $(-1, 4)$ . Find the magnitude of vector  $-3\mathbf{a} + \mathbf{b} - 4\hat{\mathbf{i}} + \hat{\mathbf{j}}$ .

$$\begin{aligned}\text{Given: } \vec{a} &= \langle -2, -4 \rangle, \vec{b} = \langle -1 - 1, 4 - 2 \rangle = \langle -2, 2 \rangle \\ -3\langle -2, -4 \rangle + \langle -2, 2 \rangle - 4\langle 1, 0 \rangle + \langle 0, 1 \rangle &= \langle 6, 12 \rangle + \langle -2, 2 \rangle - \langle 4, 0 \rangle + \langle 0, 1 \rangle = \langle 0, 15 \rangle \\ \|\langle 0, 15 \rangle\| &= \boxed{15}\end{aligned}$$

25.  $\|\mathbf{v}\| = 7, \mathbf{u} = \langle 3, 4 \rangle \leftarrow$  Done accidentally.

$$\begin{aligned}\vec{v} &= 7 * \text{UV of } \vec{u} = 7 * \frac{\vec{u}}{\|\vec{u}\|} \\ \vec{v} &= 7 * \frac{\langle 3, 4 \rangle}{\sqrt{3^2 + 4^2}} = 7 * \left\langle \frac{3}{5}, \frac{4}{5} \right\rangle \\ \vec{v} &= \boxed{\left\langle \frac{21}{5}, \frac{28}{5} \right\rangle}\end{aligned}$$

26.  $\|\mathbf{v}\| = 3, \mathbf{u} = \langle -2, 5 \rangle$

$$\begin{aligned}\vec{v} &= 3 * \text{UV of } \vec{u} = 3 * \frac{\vec{u}}{\|\vec{u}\|} \\ \vec{v} &= 3 * \frac{\langle -2, 5 \rangle}{\sqrt{(-2)^2 + 5^2}} = 3 * \left\langle -\frac{2}{\sqrt{29}}, \frac{5}{\sqrt{29}} \right\rangle \\ \vec{v} &= \boxed{-\left\langle \frac{6}{\sqrt{29}}, \frac{15}{\sqrt{29}} \right\rangle}\end{aligned}$$

30.  $\|\mathbf{u}\| = 6, \theta = 60^\circ$

$$\begin{aligned}\vec{u} &= 6 * \langle \cos(60^\circ), \sin(60^\circ) \rangle \\ \vec{u} &= 6 * \left\langle \frac{1}{2}, \frac{\sqrt{3}}{2} \right\rangle = \boxed{\langle 3, 3\sqrt{3} \rangle}\end{aligned}$$

32.  $\|\mathbf{u}\| = 8, \theta = \pi$

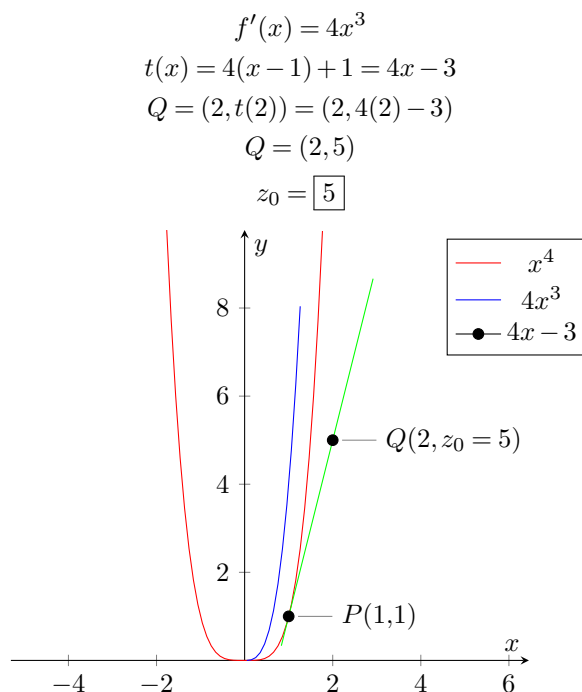
$$\begin{aligned}\vec{u} &= 8 * \langle \cos(\pi), \sin(\pi) \rangle \\ \vec{u} &= 8 * \langle -1, 0 \rangle = \boxed{\langle -8, 0 \rangle}\end{aligned}$$

38. Consider vectors  $\mathbf{a} = \langle 2, -4 \rangle, \mathbf{b} = \langle -1, 2 \rangle$ , and  $\mathbf{c} = \mathbf{0}$ . Determine the scalars  $\alpha$  and  $\beta$  such that  $\mathbf{c} = \alpha\mathbf{a} + \beta\mathbf{b}$ .

$$\begin{aligned}\text{Given: } \mathbf{a} &= \langle 2, -4 \rangle, \mathbf{b} = \langle -1, 2 \rangle, \mathbf{c} = \mathbf{0} \\ \mathbf{c} &= \alpha * \mathbf{a} + \beta * \mathbf{b} \\ \mathbf{0} &= \alpha * \langle 2, -4 \rangle + \beta * \langle -1, 2 \rangle \\ \langle 0, 0 \rangle &= \langle 2\alpha - 1\beta, -4\alpha + 2\beta \rangle \\ 2\alpha - \beta &= 0 \rightarrow 2\alpha = \beta \\ -4\alpha + 2\beta &= 0 \rightarrow -4\alpha = -2\alpha \\ \therefore \quad &\boxed{\beta = 2\alpha, \alpha \in \mathbb{R}}\end{aligned}$$

40. Consider the function  $f(x) = x^4$  where  $x \in \mathbb{R}$ .

- a. Determine the real number  $z_0$  such that point  $Q(2, z_0)$  is situated on the line tangent  $t$  to the graph of  $f$  at point  $P(1, 1)$ .



- b. Determine the unit vector  $\mathbf{u}$  with initial point  $P$  and terminal point  $Q$ .

$$\vec{u} = \frac{\langle 2 - 1, 5 - 1 \rangle}{\|\vec{u}\|}$$

$$\vec{u} = \frac{\langle 1, 4 \rangle}{\sqrt{17}} = \boxed{\left\langle \frac{1}{\sqrt{17}}, \frac{4}{\sqrt{17}} \right\rangle}$$

46. A baseball player throws a baseball at an angle of  $30^\circ$  with the horizontal. If the initial speed of the ball is 100 mph, find the horizontal and vertical components of the initial velocity vector of the baseball. (Round to two decimal places.)

$$\text{Given: } v_0 = 100\text{mph}, \theta = 30^\circ$$

$$\vec{v} = 100 \langle \cos(30^\circ), \sin(30^\circ) \rangle$$

$$\vec{v} = \langle 50\sqrt{3}, 50 \rangle = \boxed{\langle 86.60, 50.00 \rangle}$$

**2.2: 61, 64, 66, 68, 72, 74, 76, 78, 84, 89, 92, 100, 103**

61.  
64.  
66.  
72.  
74.  
76.  
78.  
84.  
89.  
92.  
100.  
103.

**2.3: 126, 130, 132, 136, 140, 142, 146, 148, 150, 152, 154, 168, 170, 172**

126.  
130.  
132.  
136.  
140.  
142.  
146.  
148.  
150.  
152.  
154.  
168.  
170.  
172.