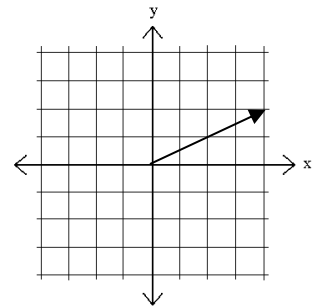**Non-Calculator**

1) Let $\mathbf{a} = \langle -4, \frac{1}{2} \rangle$ and $\mathbf{b} = \langle \frac{2}{3}, -1 \rangle$. Find $4\mathbf{a} - 3\mathbf{b}$. Write your answer in linear combination form.

2) Given Q = (7, 2) and P = (−1, −2). Find the magnitude of vector $\overrightarrow{PQ}$.

3) Find the component form of the vector in the diagram.

4) Find the unit vector in the direction of: $\mathbf{w} = \langle -15, 8 \rangle$

5) Find the unit vector in the direction of: $\mathbf{w} = \langle 9, 3 \rangle$

6) State two orthogonal vectors, one in the 2nd quadrant and the other in the 3rd quadrant. Verify that these two vectors are in fact orthogonal.

7) Find the dot product of $\mathbf{u}$ and $\mathbf{v}$, where $\mathbf{u} = \langle \frac{2}{3}, -4 \rangle$ and $\mathbf{v} = \langle -2, \frac{2}{5} \rangle$.

8) Find the dot product of $\mathbf{u}$ and $\mathbf{v}$: $\mathbf{u} = -5\langle 1, 0 \rangle + 2\langle 0, 1 \rangle$ and $\mathbf{v} = 7\langle 1, 0 \rangle - 9\langle 0, 1 \rangle$

9) Find the work done by a crane lifting a 585 lb girder 72 ft.

10) Find the inverse of A, if the inverse of A exists.

$$A = \begin{bmatrix} 4 & -2 \\ 1 & 5 \end{bmatrix}$$

Calculator

11) Given $O = (11, -12)$ and $P = (-5, 4)$, find the component form of vector $\overrightarrow{PO}$.

12) Let $\mathbf{v} = \langle -1, 1 \rangle$ and $\frac{1}{2}\mathbf{u} - 6\mathbf{v} = \langle 7, 4 \rangle$. Find $\mathbf{u}$.
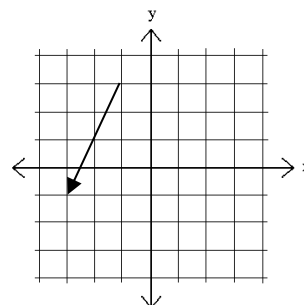
13) Find the direction angle of the vector $\mathbf{u} = \langle 7, -2 \rangle$.

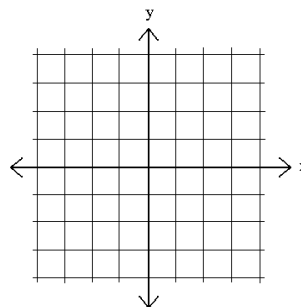14) Find the unit vector in the direction of $\mathbf{v} = \langle -9, -11 \rangle$.

15) Find the angle between the following two vectors: $\mathbf{u} = \langle 6, -1 \rangle$ and $\mathbf{v} = \langle 2, 12 \rangle$

16) Find the angle between the following two vectors: $\mathbf{u} = \langle 2, 2 \rangle$ and $\mathbf{v} = \langle -1, -4 \rangle$

17) Find the component form of the vector in the diagram.

18) Given $\mathbf{u} = \langle 8.2, 3.7 \rangle$, draw $\mathbf{u}$ with magnitude and direction.

19) Find the work done by a force $\mathbf{F}$ of 72 lbs acting in the direction of $\langle 2, 1 \rangle$ in moving an object 5 feet along the *x*-axis starting at (0,0).

20) A car is parked on the side of a hill inclined at $7°$. The weight of the car is 2345 lbs. What force $\mathbf{F}$ is required to keep the car in place?

21) Solve the system of equations using matrices.

$$x + z + w = 2$$
$$x + y + z = 3$$
$$3x + 2y + 3z + w = 8$$

22) Solve the system of equations using matrices.

$$x + 2y + z = -1$$
$$x - 3y + 2z = 1$$
$$2x - 3y + z = 5$$

23) Find the partial fraction decomposition of: $\dfrac{-x+10}{x^2+x-12}$

24) Find the partial fraction decomposition of: $\dfrac{x^2-2x+1}{(x-2)^3}$

25) Represent the problem using an augmented matrix and solve the problem.

A florist makes cut flower arrangements for Mother's Day using roses, carnations, and lilies. The florist prices the arrangement at $50; roses cost $3.50, carnations $1.50, and lilies $2. If the arrangement can have 24 flowers and there needs to be twice as many carnations as roses, how many of each type of flower is needed to make the arrangement?

26) Let $\mathbf{u} = \langle -3, 0 \rangle$, $\mathbf{v} = \langle -1, 4 \rangle$, $\mathbf{w} = \langle -2, -6 \rangle$, and $\mathbf{a} = \langle 1, -5 \rangle$. Represent each vector operation geometrically. Label your vectors.

a) $-3\mathbf{u}$

b) $\mathbf{v} + \mathbf{w}$

c) $\frac{1}{2}\mathbf{w} - \mathbf{a}$

d) $\mathbf{a} + 2\mathbf{u} + \mathbf{v}$

a)

b)

c)

d)