

VECTOR NOTES

1. Resolve the force 100 lbs. At 50° above horizontal into component form.

$$x = 100\cos 50^\circ \approx 64.279$$

$$y = 100\sin 50^\circ \approx 76.604$$

$$\therefore (64.279, 76.604)$$

2. Resolve the force 200 mph on a bearing (or heading) of 112° .

$$x = 200\cos 338^\circ \approx 185.437$$

$$y = 200\sin 338^\circ \approx -74.921$$

$$\therefore (185.437, -74.921)$$

3. a) Find the resultant of F_1 and F_2 in component form.
 b) Find the magnitude & direction (as a bearing) of the resultant vector.

$$F_1 = (-3, 7)$$

$$F_2 = (14, 5)$$

answer: a) $F_1 + F_2 = (11, 12)$

$$b) \|(11, 12)\| = \sqrt{121 + 144} = \sqrt{265} \approx 16.279$$

$$q = \tan^{-1}\left(\frac{12}{11}\right) \approx 47.510^\circ \quad |90^\circ - 47.510^\circ = 42.490^\circ|$$

$$\therefore \text{bearing} = 47.490^\circ$$

4. Find the angle, q , between $\vec{u} = (2, -2, 3)$ and $\vec{v} = (-4, -5, 2)$.

$$\cos q = \frac{u \cdot v}{\|u\| \|v\|} \quad \cos q = \frac{-8 + 10 + 6}{\sqrt{17}\sqrt{45}} \quad \therefore q \approx 73.19^\circ$$

5. Find the area of a parallelogram if $\vec{u} = (1, 4, 5)$ and $\vec{v} = (-3, 1, 2)$

$$\begin{vmatrix} i & j & k \\ 1 & 4 & 5 \\ -3 & 1 & 2 \end{vmatrix} = 3i - 17j + 13k \quad \text{answer: } \sqrt{3^2 + 17^2 + 13^2} \approx 21.61$$

6. $\vec{a} = (1, 2, -1)$

$$\vec{b} = (0, 3, 1)$$

$$\vec{c} = (2, 1, -5)$$

Find the volume of the parallelepiped: $\begin{vmatrix} 1 & 2 & -1 \\ 0 & 3 & 1 \\ 2 & 1 & -5 \end{vmatrix} = |-6| = 6 \quad \therefore \text{Volume} = 6$

7. Write $t = (7, 8)$ as a linear combination of $u = (1, 2)$ and $v = (-1, -3)$

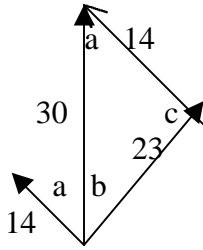
$t = au + bv$ so,

$$(7, 8) = a(1, 2) + b(-1, -3) \rightarrow \begin{matrix} 7 = a - b \\ 8 = 2a - 3b \end{matrix} \rightarrow \begin{matrix} -14 = -2a + 2b \\ 8 = 2a - 3b \end{matrix} \rightarrow \begin{matrix} -6 = -b & b = 6 \\ 7 = a - 6 & a = 13 \end{matrix}$$

$$\therefore \vec{t} = 13\vec{u} + 6\vec{v}$$

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8. Two forces act on a point. Where $F_1 = 14\text{N}$, $F_2 = 23\text{N}$ and the resultant force is 30N . Find the angle between forces.



$$30^2 = 14^2 + 23^2 - 2(14)(23)\cos C$$

$$900 = 725 - 644\cos C$$

$$\cos C = -\frac{175}{644}$$

$$\angle C \approx 105.77^\circ$$

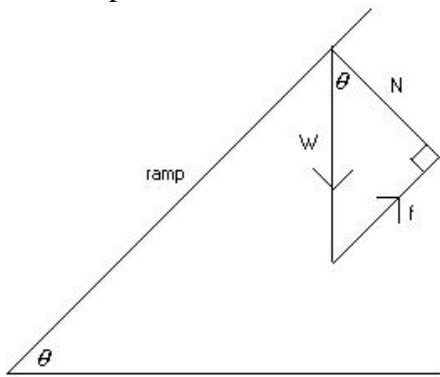
$$\therefore \angle A + \angle B = 180^\circ - 105.77^\circ = 74.23^\circ$$

9. Find unit vector: $\vec{v} = (1, 2)$

$$\|\vec{v}\| = \sqrt{1+4} = \sqrt{5}$$

$$\therefore \text{unit vector } \vec{v} = \left\langle \frac{1}{\sqrt{5}}, \frac{2}{\sqrt{5}} \right\rangle$$

10. Ramp Problems



N = force needed to keep object on ramp

q = ramp angle w = weight of object f = force needed to push object up ramp $\therefore \sin q = \frac{f}{w}$

11. Bearing or Heading

