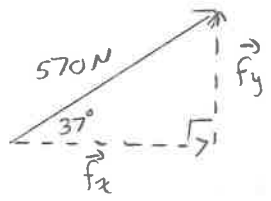
W5 – Resolution of Vectors in to Rectangular Components Unit 4

MCV4U

Iensen

1) Determine the magnitudes of the horizontal and vertical components of each force.

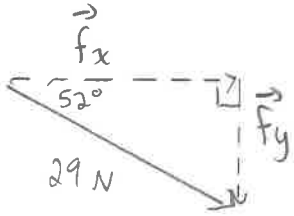
a) magnitude of 570 N, $\theta = 37°$ counterclockwise from the horizontal



$|\vec{f}_x| = 570\cos(37) \simeq 455.2\ N$

$|\vec{f}_y| = 570\sin(37) \simeq 343.0\ N$

b) magnitude of 29 N, $\theta = 52°$ clockwise from the horizontal



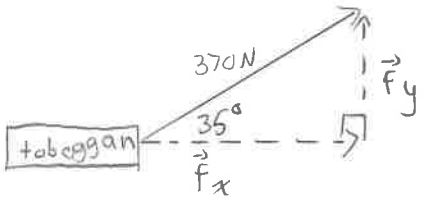
$|\vec{f}_x| = 29\cos(52) \simeq 17.9\ N$

$|\vec{f}_y| = 29\sin(52) \simeq 22.9\ N$

2) A woman is pulling on a rope attached to a toboggan with a 370 N force at an angle of 35° to the horizontal. Find the magnitude of the force pulling the sled forward and the magnitude of the force pulling the sled upward.

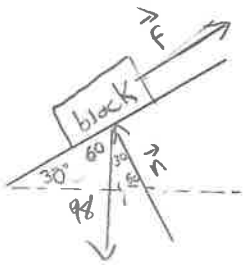
$|\vec{f}_x| = 370\cos(35) \simeq 303.1\ N$ forward

$|\vec{f}_y| = 370\sin(35) \simeq 212.2\ N$ upward.

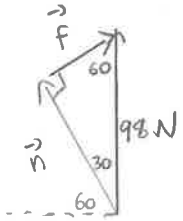


3) A 10 kg block lies on a smooth ramp that is inclined at 30°. What force, parallel to the ramp, would prevent the block from moving. (Assume that 1 kg exerts a force of 9.8 N)

Position:



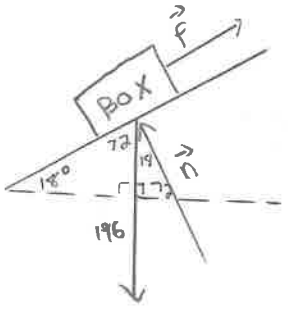
Vectors:



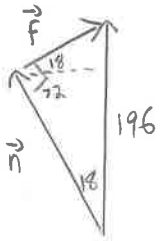
$|\vec{f}| = 98\sin(30) = 49\ N$

4) A 20 kg box rests on a ramp that is inclined 18°. Resolve the weight into rectangular vector components that keep the box at rest.

Positron's:



Vector's:



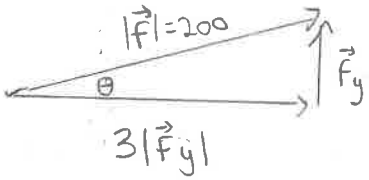
$|\vec{n}| = 196\cos(18°) \simeq 186.4\ N$

$|\vec{F}| = 196\sin(18°) \simeq 60.6\ N$

186.4 N perpendicular to the ramp

60.6 N parallel to the ramp.

5) Resolve a 200 N force into two rectangular vector components such that the ratio of their magnitudes is 3:1. Calculate the angle between the greater component and the 200 N force.

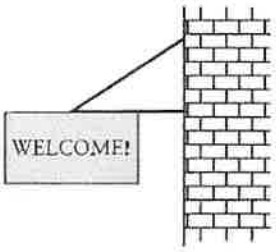


$\tan\theta = \dfrac{|\vec{F}_y|}{3|\vec{F}_y|}$

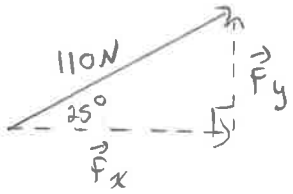
$\tan\theta = \frac{1}{3}$

$\theta \simeq 18.43°$

6) A sign is supported as shown in the diagram. The tension in the slanted rod supporting the sign is 110 N at an angle of 25° to the horizontal.



a) Draw a vector diagram showing the vector components of the tension vector.



b) What are the vertical and horizontal vector components of the tension?

$|\vec{F}_x| = 110\cos(25°) \simeq 99.7\ N$

$|\vec{F}_y| = 110\sin(25°) \simeq 46.5\ N$

ANSWER KEY:

1)a) $\overrightarrow{F_h} = 455.2\ N, \overrightarrow{F_v} = 343.0\ N$ **b)** $\overrightarrow{F_h} = 17.9\ N, \overrightarrow{F_v} = -22.9\ N$

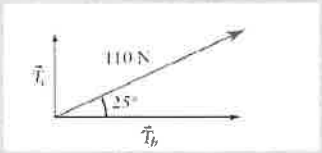
2) forward: 303.1 N; upward: 212.2 N

3) 49 N

4) $|\vec{n}| = 186.41\ N\ |\vec{f}| = 60.57\ N$

5) $18.4°$

6)a)



b) 99.7 N **c)** 46.5 N