Day 3

Monday, December 11, 2017
8:10 AM

Guided Notes:

8.1 Vectors guided not...

Quiz Review

7-5 and 8.1 Word Prob...

13 Two parametric equations are shown below, where $t \geq 0$.

$$x = \frac{1}{3}\sqrt{t} + 3$$
$$y = 4t^2 - 7$$

Which nonparametric equation can be used to graph the curve described by the parametric equations?

A $y = \frac{4}{9}(x + 1) - 7$

B $y = \frac{4}{3}(x + 3) - 7$

C $y = 36(x - 1)^4 - 7$

D $y = 324(x - 3)^4 - 7$

$x - 3 = \frac{1}{3}\sqrt{t}$

$3x - 9 = \sqrt{t}$

$9(x-3)^2 = t$

$y = 4(9(x-3)^2)^2 - 7$

$y = 4(81(x-3)^4) - 7$

$= 324(x-3)^4 - 7$

22 A circle is graphed using the parametric equations shown below.

$$x = 5\cos(t) + 3$$
$$y = 5\sin(t) - 1$$

Where is the center of the circle located?

A (-3, -1)

B (-3, 1)

C (3, -1)

D (3, 1)

$\frac{x-3}{5} = \cos t$

$\frac{y+1}{5} = \sin t$

$\left(\frac{x-3}{5}\right)^2 + \left(\frac{y+1}{5}\right)^2 = 1$

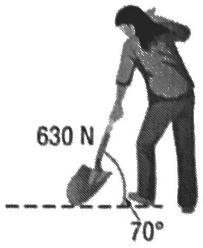
$\frac{(x-3)^2}{25} + \frac{(y+1)^2}{25} = 1$

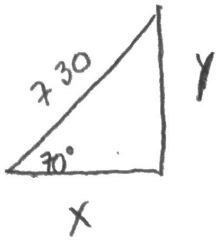
$(3, -1)$

Today's Goal: Apply our knowledge of parametric equations to solve vectors.

Real-World EXAMPLE 6 Resolve a Force into Rectangular Components

A. GARDENING While digging in his garden, Will pushes a shovel into the ground with a force of 630 newtons at an angle of 70° with the ground. Draw a diagram that shows the resolution of the force that Will exerts into its rectangular components.





rectangular components = x & y forces

$\sin 70 = \frac{Y}{730}$

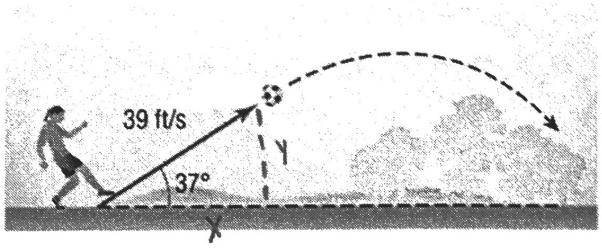
$Y = 686\ N$

$\cos 70 = \frac{X}{730}$

$X = 250\ N$

Real-World EXAMPLE 6 **Guided Practice**

SOCCER A player kicks a soccer ball so that it leaves the ground with a velocity of 39 feet per second at an angle of 37° with the ground. Find the magnitude of the horizontal and vertical components of the velocity.



$\sin 37 = \frac{Y}{39}$

$Y = 23.5$ ft/s

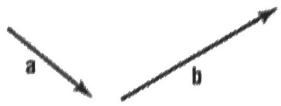
$\cos 37 = \frac{X}{39}$

$X = 31.1$ ft/s

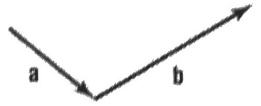
KeyConcept Finding Resultants

Triangle Method (Tip-to-Tail)

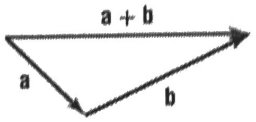
To find the resultant of a and b, follow these steps.



Step 1 Translate b so that the tail of b touches the tip of a.

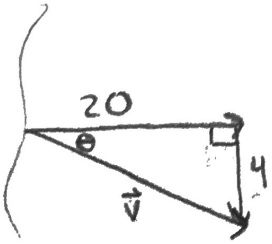


Step 2 The resultant is the vector from the tail of a to the tip of b.



Real-World EXAMPLE 5 ☑ Guided Practice

ROWING Jamie rows her boat due east at a speed of 20 feet per second across a river directly toward the opposite bank. At the same time, the current of the river is carrying her due south at a rate of 4 feet per second. Find Jamie's speed and direction relative to the shore.



$20^2 + 4^2 = \vec{v}^2$

$400 + 16 = \vec{v}^2$

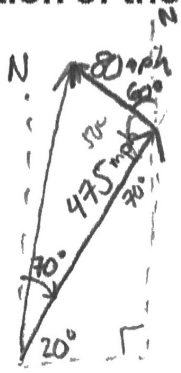
$\vec{v} = 20.4$ ft/s

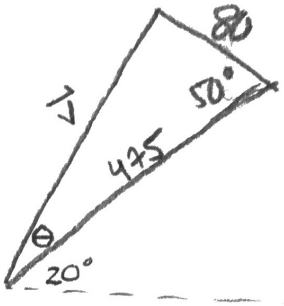
$\tan^{-1}\left(\frac{4}{20}\right) = \theta$

$\theta = 11.3°$ South of east

Real-World EXAMPLE 5 Use Vectors to Solve Navigation Problems

AVIATION An airplane is flying with an airspeed of 475 miles per hour on a heading of 70° east of North. If an 80-mile-per-hour wind is blowing 60°west of north, determine the velocity and direction of the plane relative to the ground.





$\vec{v}^2 = 475^2 + 80^2 - 2(475)(80)\cos(50°)$

$\vec{v}^2 = 183173.1417$

$\vec{v} = 428$ mph

$\frac{\sin 50}{428} = \frac{\sin \theta}{80}$

$61.28 = 428 \sin\theta$

$0.14317 = \sin\theta$

$8.23° = \theta$

$8.23° + 20° = 28.23°$

Notation

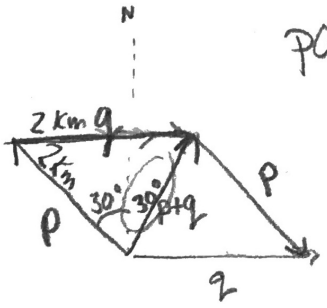
061.8° Is read as 61.8° east of due north.

N30°W Is read as 30° west of north.

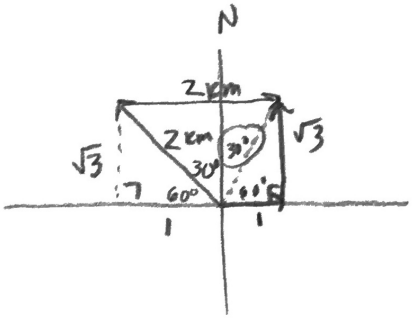
Real-World EXAMPLE 3 Find the Resultant of Two Vectors

HIKING While hiking in the woods, Shelly walks 2 kilometers N30°W from her camp, and then walks 2 kilometers directly east. How far and at what quadrant bearing is Shelly from her camp?

parallelogram method



N30°E



horizontal = -1+2 = 1

vertical = $\sqrt{3}$

$\tan^{-1}\left(\frac{\sqrt{3}}{1}\right) = 60°$

$1^2+\sqrt{3}^2 = c^2$

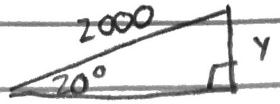
$4 = c^2$

$2 = c$

N30°E

Assignment: Page 488 19,21,35,37,43,49,68
Quiz on Wednesday:)

7.5 + 8.1 Word Problems Key

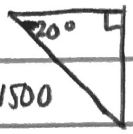
1. 

$2000\cos-20=x$

$1879.4\text{ N}=x$

a) hor = 3288.9 N

vert = 171 N



$1500\cos-20=x$

$1409.5\text{ N}=x$

$2000\sin-20=y$

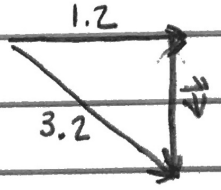
$684\text{N}=y$

$1500\sin-20=y$

$-513\text{ N}=y$

b) $\sqrt{3288^2+171^2}=3292.4\text{ N}$ (pythagorean thm)

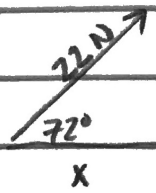
c) no, because taking away from one angle would increase the other angle. The difference would be the same.

2. 

$1.2^2+\vec{v}^2=3.2^2$

$\vec{v}^2=8.8$

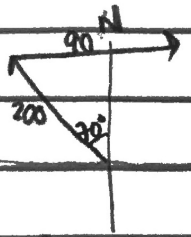
$\vec{v}=3\text{ m/s}$

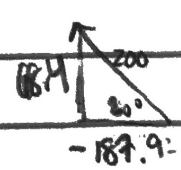
3. 

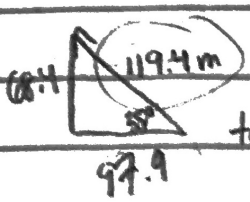
$22\cos 72=x$

6.8 N

The horizontal force would increase with a decrease in angle

4. 





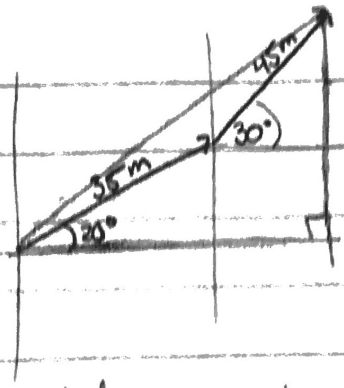
$\tan^{-1}\left(\frac{68.4}{97.9}\right)=35°$

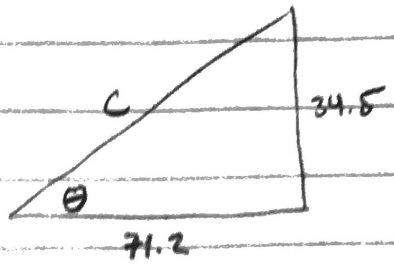
$90-35°=55°\text{ W}$

horizontal $=-187.9+90=-97.9\text{ m}$

vertical $=68.4\text{ m}$

5.





add horizontal components: $35\cos 20 + 45\cos 30 = 71.2\text{m}$

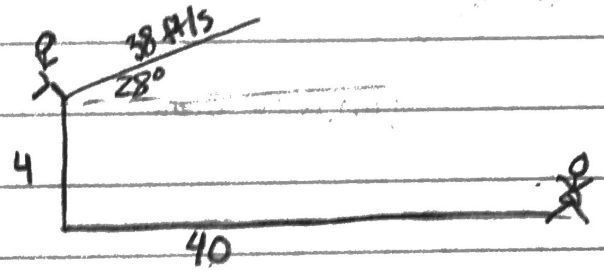
add vertical components: $35\sin 20 + 45\sin 30 = 34.5\text{m}$

$71.2^2 + 34.5^2 = 6259.69 = c^2$

$79.1\text{m} = c$

$\theta = \tan^{-1}\left(\frac{34.5}{71.2}\right) = \text{N}25.85^\circ\text{E}$

6.



$X = tv_0\cos\theta = t(38)\cos(28) = 33.6t \qquad t = \frac{x}{33.6}$

$y = tv_0\sin\theta - \frac{1}{2}gt^2 + h_0 = t(38)\sin(28) - \frac{1}{2}(32)(t^2) + 4$

$= -16t^2 + 17.8t + 4$

$= -16\left(\frac{x}{33.6}\right)^2 + 17.8\left(\frac{x}{33.6}\right) + 4$

$= -0.01417x^2 + 0.52976x + 4$

a) $y = -0.01417(40)^2 + 0.52976(40) + 4 = 2.5184$ ft high

b) $-\frac{b}{2a} = -\frac{0.52976}{2(-0.01417)} = 18.7$

$y = -0.01417(18.7)^2 + 0.52976(18.7) + 4$

$= 8.95$ ft

7. $x = tV_0\cos\theta = t(28)\cos(60) = 14t$

$y = tV_0\sin\theta - \frac{1}{2}gt^2 + h_0 = t(28)\sin(60) - \frac{1}{2}(32)t^2 + 5 = 24.25t - 16t^2 + 5$

8a) $x = tV_0\cos\theta = t(100)\cos(39) = 77.7t \qquad t = \frac{x}{77.7}$

$y = tV_0\sin\theta - \frac{1}{2}gt^2 + h_0 = t(100)\sin(39) - \frac{1}{2}(32)t^2 + 0 = -16t^2 + 62.9t$

b) $y = -16\left(\frac{x}{77.7}\right)^2 + 62.9\left(\frac{x}{77.7}\right)$

$= -0.00265x^2 + 0.80952x$

$-\frac{b}{2a} = \frac{-0.80952}{2(-0.00265)} = 152.729$

$y = -0.00265(152.729)^2 + 0.80952(152.729)$

$= 61.8$ ft