Non-perpendicular/non-parallel vector addition

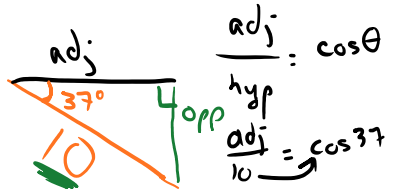
Thursday, September 09, 2010 9:20 AM

Vector Components:

Components = parts

All vectors have 2 components one component runs parallel to the x-axis, one component runs parallel to the y-axis.

We find components using trigonometry



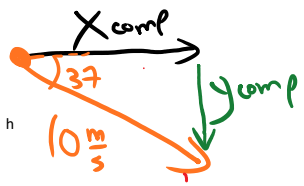
$\frac{adj}{hyp} = \cos\theta$

$\frac{adj}{10} = \cos 37$

$adj = 10\cos 37$

$= 8.0$ m

Find the components of the vector below:



$\frac{opp}{hyp} = \sin\theta$

$\frac{opp}{10} = \sin 37$

$opp = 10\sin 37 = 6.0$

$X = 50\cos 30$

$= 43$

7a) x comp: 8.66 →, y comp: 5 ↑

b) x comp: 14.1 ←, y comp: 14.1 ↑

c) x comp: 20 ←, y comp: 34.6 ↓

d) x comp: 4.4 ←, y comp: 14.3 ↓

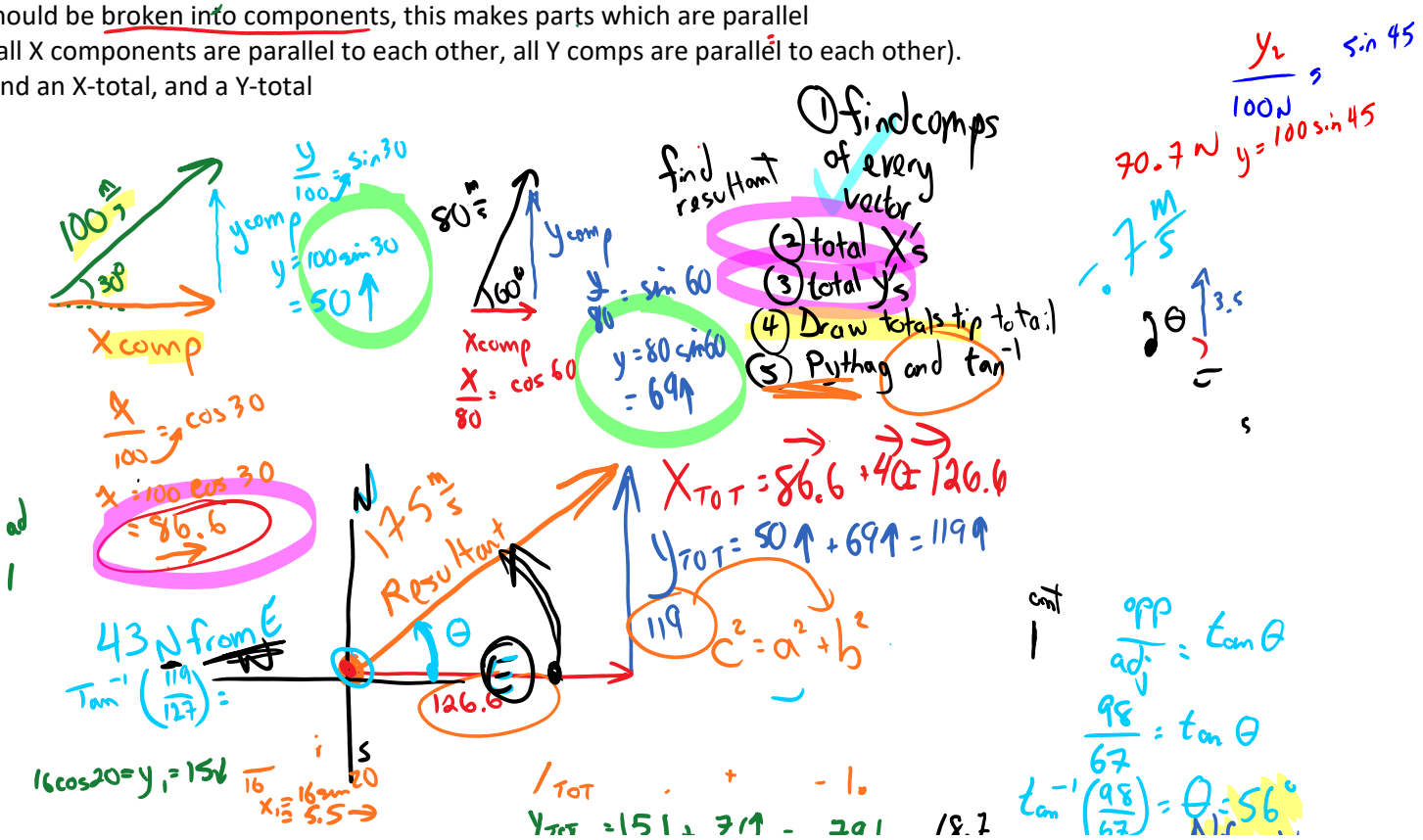
e) x comp: 17 ←, y comp: 0

f) x comp: 7.66 →, y comp: 6.4 ↓

Components are used to simplify vector addition.

Vectors that neither parallel, nor perpendicular should be broken into components, this makes parts which are parallel (all X components are parallel to each other, all Y comps are parallel to each other).

Find an X-total, and a Y-total



$16\cos 20 = y_1 = 15\downarrow$ $\quad x_1 = 16\sin 20 = 5.5\rightarrow$

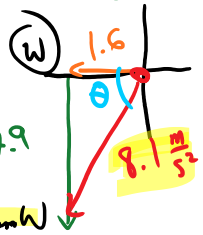
$y_{TOT} = 15\downarrow + 7.1\uparrow = 7.9\downarrow$ $\quad \tan^{-1}\left(\frac{98}{67}\right) = \theta = 56°$ N from W

18.7 from W

Find an X total

And a y total

$\tan\theta = \frac{7.9}{1.6}$ $\quad \theta = \tan^{-1}\left(\frac{7.9}{1.6}\right) = 79°$ S from W



Draw those tip to tail,(X total and Y total)
Resulting vector can then be seen.

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find the resultant of

$x = \sin 30$ $\quad x = 10$

$\frac{y}{20} = \cos 30$ $\quad y = 17.3\uparrow$

$x = 12\rightarrow$

$\frac{x}{13} = \cos 23$ $\quad \frac{y}{13} = \sin 23$ $\quad y = 5\downarrow$

$x_{TOT} = 10\leftarrow + 12\rightarrow = 2\rightarrow$

$y_{TOT} = 17.3\uparrow + 5\downarrow = 12.3\uparrow$

$c^2 = a^2 + b^2$ $\quad \tan^{-1}\left(\frac{12.3}{2}\right) = 81° N$ from E

N from E

$\frac{opp}{adj} = \tan\theta$ $\quad = \theta$

1) Draw vectors
2) Break into x and y components
3) Find X total and Y total <= watch for negative directions
4) Draw X total and Y total TIP TO TAIL
5) Pythagoras' theorem for magnitude
6) $\tan^{-1}$ for angle

Find the resultant of 10 N at 30° E from S and 14 N at 26° S from W

N

$x = 14\cos 26 = 12.5$

$14\sin 26 = 6.1$

$y = 10\cos 30 = 8.66\downarrow$

$x = 10\sin 30 = 5\rightarrow$

$x_{TOTAL} = 5\rightarrow + 12.5\leftarrow$

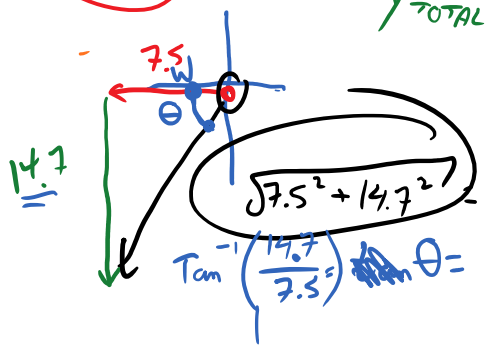
$= -7.5 \quad 2.5$

W

$y_{TOTAL} = 8.66\downarrow + 6.1\downarrow$

$y_{TOTAL} = 8.66\downarrow + 6.1\downarrow$

$= 14.7\downarrow$



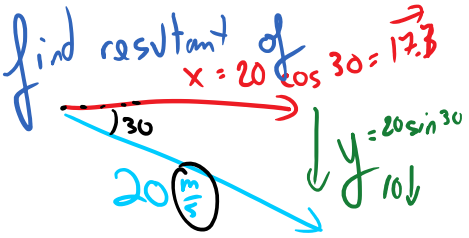
16.5 N

63° S from W

$\tan\theta = \frac{7.5}{14.7}$ W from S

$\theta = \tan^{-1}\left(\frac{7.5}{14.7}\right) = 27°$

find resultant of

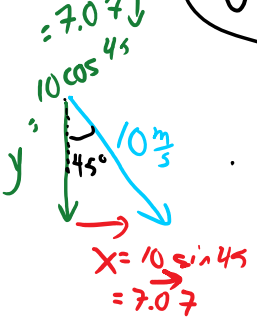


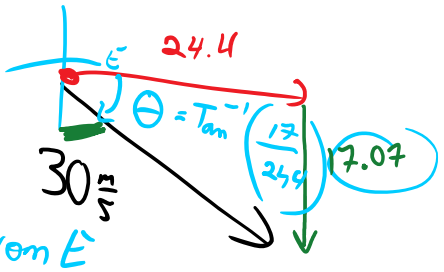
$X_{TOT} = 17.3 + 7.07$

$= 24.4$

$y_{TOT} = 10\downarrow + 7.07\downarrow$

$= 17\downarrow$





35° S from E

55° E from S