Lochlan

Physics 11

Unit 3 – 2D Kinematics
Section 3.1: Working with Vectors

Remember the rules for adding vectors?

- We can put them in any order.
- Each time we add a new vector, we start where the last one left us.
- The answer (resultant) goes from start to finish.

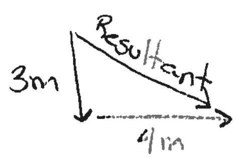
To subtract vectors, we add the opposite.

To multiply a vector by a scalar, we multiply its magnitude and keep its direction the same.

Examples:

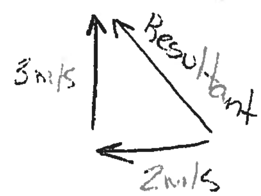
3 m Down – 4 m Left

3m Down + 4m right



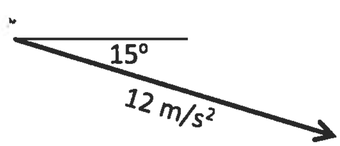
2 m/s West + (1 m/s North) x 3

2 m/s West + 3 m/s North



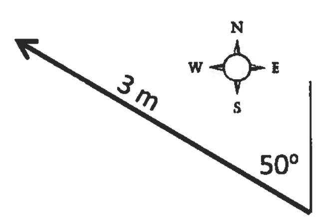
What if, rather than *drawing* the resultants (like we just did), I wanted you to write them in words?

Examples: Describe the magnitude and direction of the following vectors.



Magnitude: $12 m/s^2$
Direction: 15° below horizontal

$12 m/s^2$ [15° below horizontal]



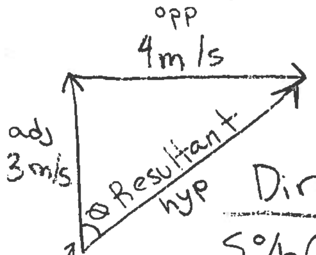
Magnitude: 3m
Direction: 50° west of North
aka: 40° North of West ↑
(same thing as the first)

second direction is the one being "compared" to th "reference" directi

3m [50° West of North]

Now let's put it all together (and review trigonometry).

Examples: Write the resultant.



always define a vector's direction from its tail

3 m/s up + 4 m/s right

Direction

S°/h C^a/h T°/a

$\tan\theta = \frac{4}{3}$

$\tan^{-1}(\tan\theta) = \tan^{-1}(\frac{4}{3})$

$\theta = \tan^{-1}(\frac{4}{3})$

$\theta = 53.1°$

Magnitude (Length)

$a^2 + b^2 = c^2$

short sides (legs) — hypotenuse

$\pm\sqrt{a^2+b^2} = c$

$\pm\sqrt{3^2+4^2} = c$

$5 = c$

$90° - 53.1° = 36.9°$

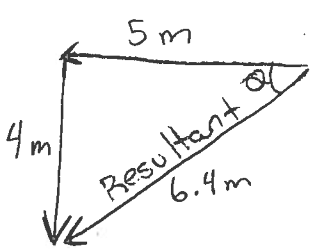
Answer: 5 m/s [53.1° right of vertical]

* Or (even better): 5 m/s [36.9° above horisontal]

5 m west – 2x(2 m north)

= 5m west − 4m north

= 5m west + 4 m south



$\sqrt{5^2+4^2} = c$

$\sqrt{25+16} = 6.4$

$\tan\theta = \frac{4}{5}$

$\tan^{-1}(\tan\theta) = \tan^{-1}(\frac{4}{5})$

$\theta = \tan^{-1}(\frac{4}{5})$

$\theta = 38.7$

Answer: 6.4m (38.7° south of west)