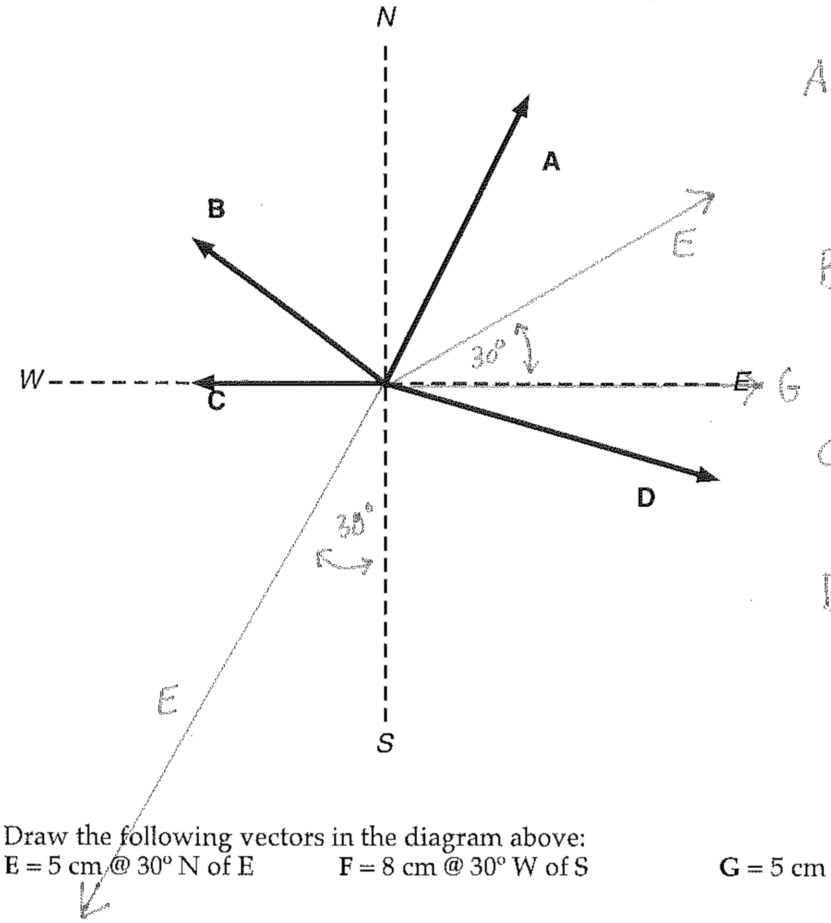
NAME: KEY

Vector Review

1. Measure the magnitudes and directions of the following vectors:



A = 4.3 cm @ 64° N of E
or [26° E of N]

B = 3.2 cm @ 37° N of W
(or 53° W of N)

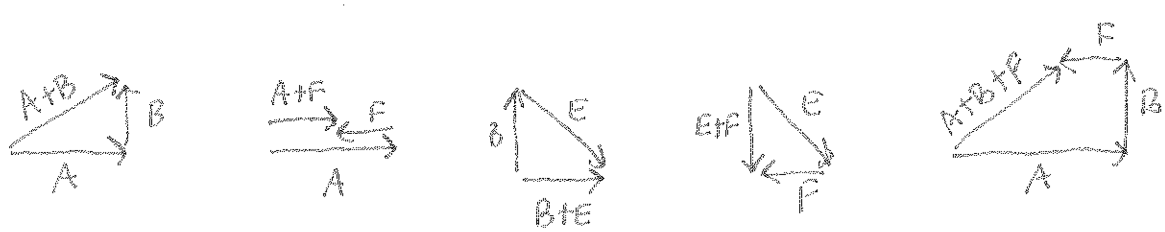
C = 2.5 cm W

D = 4.6 m @ 16° S of E
(or 74° E of S)

2. Draw the following vectors in the diagram above:
E = 5 cm @ 30° N of E   **F** = 8 cm @ 30° W of S   **G** = 5 cm E

3. Make reasonable sketches that shows **A** + **B** and **B** + **C**. Make sure to label the vectors and clearly show the resultants.
A = 100 km, 20° North of East.   **B** = 60 km, 60° North of West   **C** = 40 km, 35° South of West

4. Using the vectors above above, show the following (and make sure to label the vectors and clearly show the resultants):
a) **A** + **B**   b) **A** + **F**   c) **B** + **E**   d) **E** + **F**   4) **A** + **B** + **F**



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5. Calculate the speeds of the velocities with the given components:

a. $v_x = 12$ m/s $v_y = 20$ m/s

$v^2 = v_x^2 + v_y^2$ $v^2 = (12)^2 + (20)^2$

$v^2 = 544 \rightarrow \boxed{v = 23.3 \text{ m/s}}$

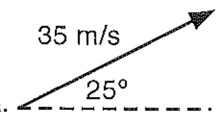
b. $v_x = 15$ m/s $v_y = -15$ m/s

$v^2 = (15)^2 + (-15)^2$

$v^2 = 450$

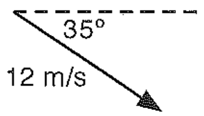
$\boxed{v = 21.2 \text{ m/s}}$

6. Calculate the components of each of the velocities shown:

a. 

$v_x = v\cos\theta$

$v_y = v\sin\theta$

b. 

$v_x =$ 31.7 m/s

$v_y =$ 14.8 m/s

$v_x =$ 9.8 m/s

$v_y =$ −6.9 m/s

Negative because pointing down!

c. A ball is kicked with a velocity of 25 m/s at an angle of 65° above the horizontal.

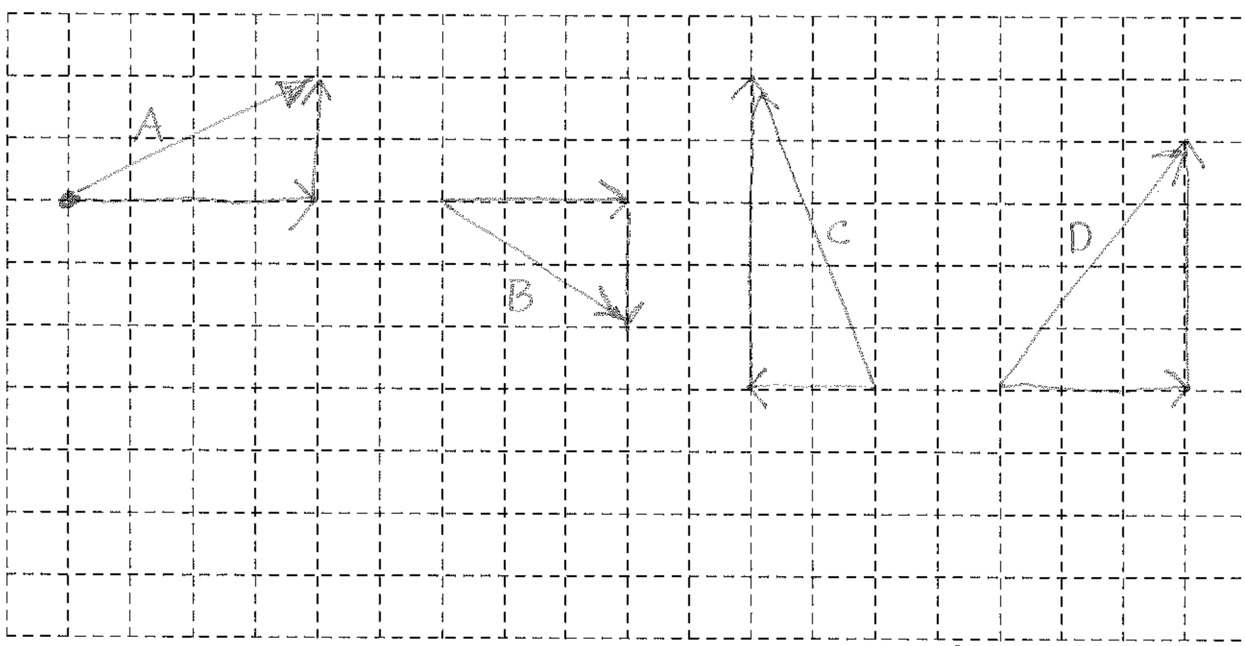
$v_x =$ 10.6 m/s $v_y =$ 22.7 m/s

d. A pen is thrown with an initial velocity of 15 m/s at an angle of 25° below the horizontal.

$v_x =$ 13.6 m/s $v_y =$ −6.3 m/s

7. Draw the following vectors and calculate their magnitudes:

A) $A_x = 4$ $A_y = 2$ **B)** $B_x = 3$ $B_y = -2$ **C)** $C_x = -2$ $C_y = 5$ **D)** $D_x = 3$ $D_y = 4$



$|A| = \sqrt{4^2 + 2^2}$

$= \sqrt{20}$

$\boxed{|A| = 4.47}$

$|B| = \sqrt{3^2 + (-2)^2}$

$= \sqrt{13}$

$\boxed{|B| = 3.6}$

$|C| = \sqrt{(-2)^2 + (5)^2}$

$= \sqrt{29}$

$\boxed{|C| = 5.4}$

$|D| = \sqrt{3^2 + 4^2}$

$= \sqrt{25}$

$\boxed{|D| = 5}$

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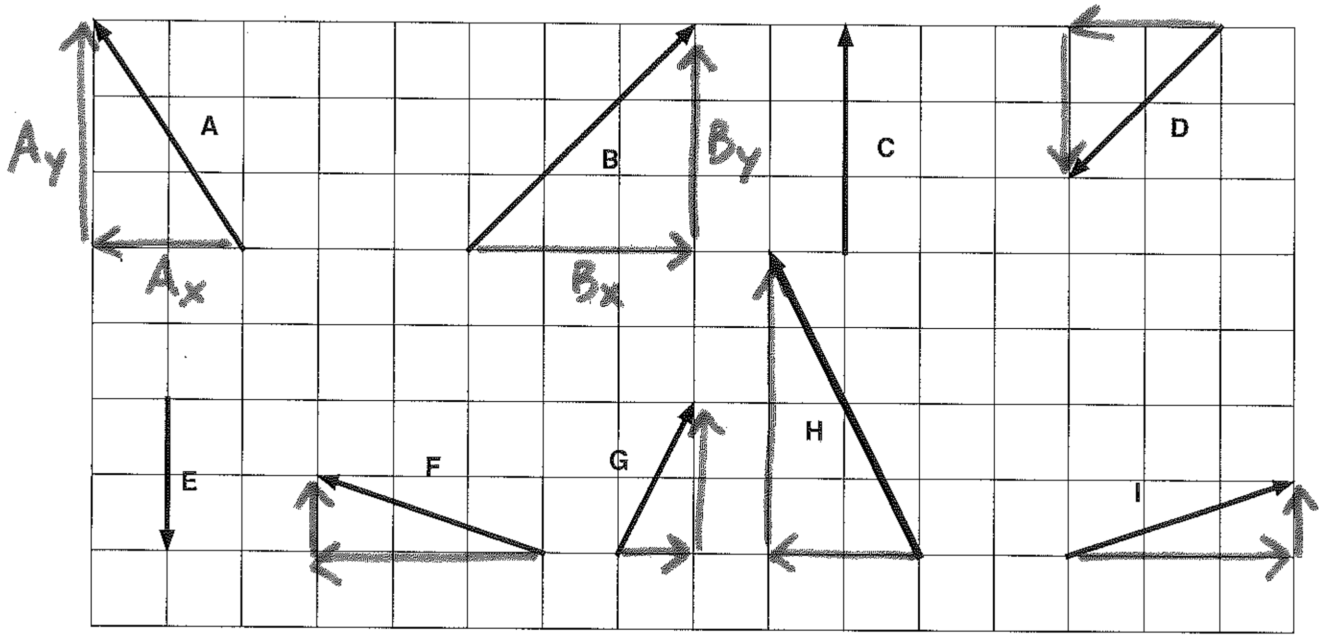
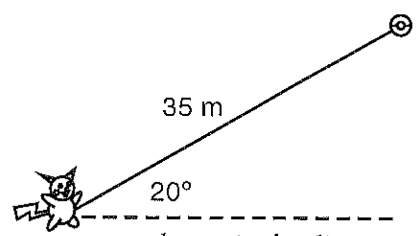
8. Show the components of the following vectors and then give the components below the diagram.



A_x = -2 & A_y = 3 B_x = 3 & B_y = 3 C_x = 0 & C_y = 3

D_x = -2 & D_y = -2 E_x = 0 & E_y = -2 F_x = -3 & F_y = 1

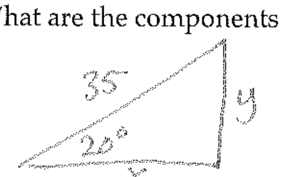
G_x = 1 & G_y = 2 H_x = -2 & H_y = 4 I_x = 3 & I_y = 1



9. Pikachu sees a Pokeball 35 meters away, as shown in the diagram above (which is NOT to scale.) He runs straight to the Pokeball in 9 seconds.
   a. How fast did Pikachu move?

$V = \frac{d}{t}$ $V = \frac{35}{9} = \boxed{3.9 \text{ m/s}}$

   b. What are the components of Pikachu's displacement?



$x = d\cos\theta$
$x = 35 \cos 20$
$\boxed{x = 32.9 \text{ m}}$

$y = d\sin\theta$
$y = 35 \sin 20$
$\boxed{y = 12 \text{ m}}$

   c. What are the components of Pikachu's velocity?

2 ways!

$V_x = \frac{x}{t}$
$V_x = \frac{32.9}{9}$
$\boxed{V_x = 3.7 \text{ m/s}}$

$V_y = \frac{y}{t}$
$= \frac{12}{9}$
$\boxed{V_y = 1.3 \text{ m/s}}$

$V_x = V\cos\theta$
$= 3.9 \cos 20$
$\boxed{V_x = 3.7 \text{ m/s}}$

$V_y = V\sin\theta$
$= 3.9 \sin 20$
$\boxed{V_y = 1.3 \text{ m/s}}$

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10. A plane has a velocity made of a horizontal component of 35 m/s East and a vertical component of 20 m/s North. After 2 hours, how far away is it from its starting point?

$V_x = 35$ m/s (E)
$V_y = 20$ m/s (N)
$t = 2$ hrs $= 7200$ s
$d = ?$

$V^2 = V_x^2 + V_y^2$
$V^2 = (35)^2 + (20)^2$
$V^2 = 1625$
$V = 40.3$ m/s
$d = vt \rightarrow d = (40.3)(7200)$ $\boxed{d = 290{,}000\text{ m}}$

or $X = V_x t = (35)(7200) = 252{,}000$ m
$y = V_y t = (20)(7200) = 144{,}000$ m
& $d^2 = x^2 + y^2 = (252{,}000)^2 + (144{,}000)^2$

11. A river flows due West with a current of 4 m/s. A boater can always travel with a water speed of 7 m/s.

a. What is the fastest resultant velocity the boater can have? In what direction must she point the boat?

↳ with the current ∴ WEST

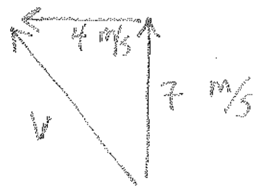
& 4, 7 $7 + 4 = 11$ m/s

b. What is the slowest resultant velocity the boater can have? In what direction must she point the boat?

↳ Against current ∴ EAST

4, 7 $7 - 4 = 3$ m/s

c. If she points her boat due North, what is her resultant speed? Include a sketch showing how the vectors add.



$V^2 = 7^2 + 4^2$
$V^2 = 65$
$\boxed{V = 8.06\text{ m/s}}$

direction is ~NW

d. If she points her boat due North, and the river is 150 meters across, how long will it take her to cross the river?

∴ $V_y = 7$ m/s
$y = 150$ m

$y = V_y t$
$150 = (7)t$
$\boxed{t = 21.4\text{ s}}$

e. From part c and d, she drifted West with the current. How far West did she drift?

$X = V_x t$

$X = (4)(21.4)$

$\boxed{X = 85.7\text{ m}}$