

Name: _____

DISC: _____

Score: ____ / 20

Instructions:

- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers.

Q1	Q2	Q3	Q4
5	5	5	5

PHYSICAL QUANTITY	SYMBOL	UNITS
Mass	M	kg
Length	x	m
Time	t	s
Force	F	$kg\ m/s^2$

1. The force on a spring is expressed as $F = -kx$, where k is known as the *spring constant*. Using the information in the table above, find the units on the *spring constant* k . **(Week 1 Discussion 1-2)**

This is a question of dimensional analysis. The table tells us the dimensions of Force and length. We can use this information and algebra together to find the dimensions (units) of k :

$$[F] = kg \frac{m}{s^2} = [k][x]$$

$$kg \frac{m}{s^2} = [k] m$$

$$\frac{kg}{s^2} = [k]$$

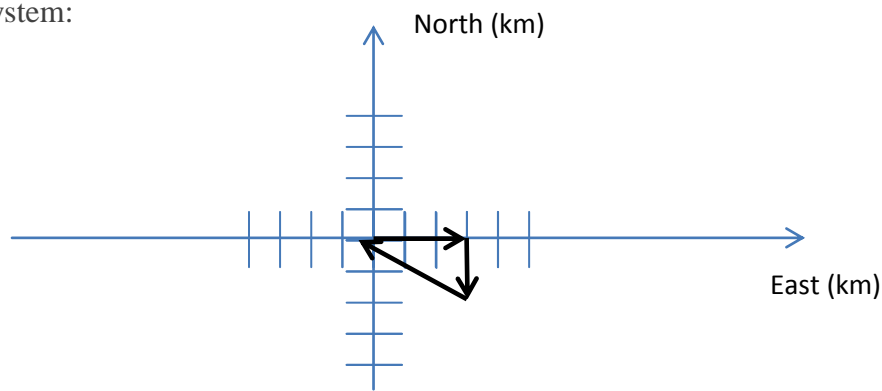
Answer: 5 pts

You are on a hike through the woods. The table below describes the path you took.

STEP	DIRECTION	DISTANCE
1	East	3 km
2	South	2 km
3	30° north-of-west	4 km

- a. Set up a coordinate system, with (0 km, 0 km) your starting point (let the $+x$ -axis be East). Draw your path through the woods. **(Week 2 Discussion 2-2)**

To solve this problem we first need a coordinate system. Then we can plot our vectors on that coordinate system:



For the step 3 vector:

$$v_{3x} = (4 \text{ km}) \cos 30^\circ = 3.46 \text{ km West of the end of step 2 ; } v_{3y} =$$

$$(4 \text{ km}) \sin 30^\circ = 1 \text{ km North of the end of step 2}$$

- b. How far away from your starting point (0 km, 0 km) do you stop? In what direction?

You will wind up 0.46 km west of the starting position.

Answer: 3 pts

3. You have a bag which contains 2 types of coins: dimes (\$0.10) and nickels (\$0.05).

- a. You want to know how many of each type of coin you have in the bag, without opening the bag, removing the coins, and counting each type. What information would help you solve this problem?

(Week 1 Discussion 1-3) Any two of the following are needed:

- The total number of coins in the bag
- The total value of the coins in the bag
- The number of any 1 coin

- b. Someone now tells you the following information:

- The bag contains 10 coins.
- The bag contains \$0.90.

How many of dimes and nickels are in the bag?

Dimes:	Nickels:
8	2

Dimes: 1 pt.
Nickels: 1 pt.
Algebra: 1pt.

This is a problem of two equations in two unknowns:

Let n be the number of nickels and d be the number of dimes.

$$n + d = 10$$

$$\$0.05 n + \$0.10 d = \$0.90 \text{ multiply through by 100}$$

$$n + d = 10 \text{ multiply through by 5}$$

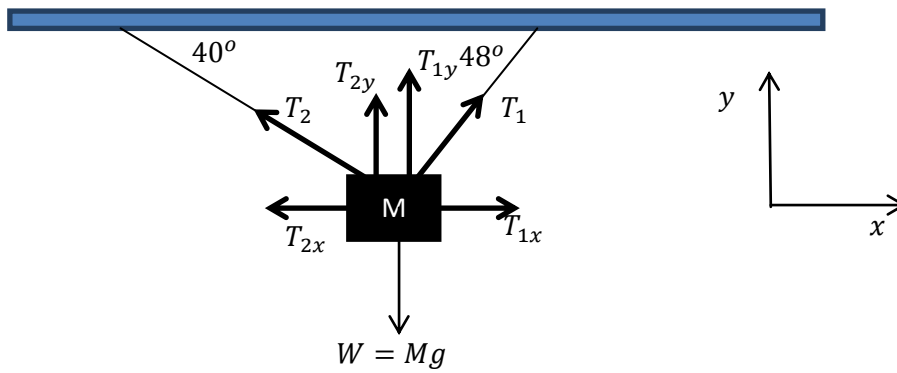
$$5n + 10d = 90$$

$$5n + 5d = 50$$

$$(-) \quad \underline{5n + 10d = 90}$$

$-5d = -40$ so $d = 8$, after dividing both sides by 5. Now use the equation $n + d = 10$ and substitute for d ; $n = 10 - 8 = 2$.

4. A block hangs from the ceiling as shown in the diagram:



- a. The block is in *equilibrium*. What does this mean? (**Lecture 2**)

If the block is in equilibrium, it experiences no net acceleration.

- b. On the diagram above, draw all of the force vectors *and* their components. Remember to label all of your vectors.

Definition: 2
pts.

Vectors: 3 pts.