Unit #1 – Introduction To Vectors Progress Check

The purpose of the progress check is to diagnose areas that you need more practice with before the test.

- 1. Answer the questions on this handout. Treat it like a test. DO NOT look at the answers until you have finished all of the questions.
- 2. Use the answers provided to check and see how you did.
- 3. Use the additional review questions provided to practice more questions like the ones you had trouble with in this package.
- 4. Although this progress check contains a wide selection of questions from this unit, it does not cover ALL of the possible questions from the unit.
- 1. Draw the following vectors. Include a scale.
- a) 6 km [N25°W] b) 550 m [S50°E]

2. In the following diagram, state a pair of vectors that are:



Equal	
Opposite	
Parallel, But Not Equal	
Same Magnitude, But Not Parallel.	

3. Calculate the magnitude and direction of the following vectors. State all directions as bearings.



4. If $|\vec{a}| = 100$ km [N75°E] and $|\vec{b}| = 85$ km [S10°W], find $\vec{a} + \vec{b}$.

- 5. If $|\vec{a}| = 25$ cm, $|\vec{b}| = 10$ cm, and the two vectors make an angle of 65°, find:
- a) $\vec{a} \vec{b}$

b) $2\vec{a} + 3\vec{b}$

6. A gardener pushes a wheelbarrow up a 32° hill using a force of 120 N (parallel to the hill). Calculate the horizontal and vertical forces acting on the wheelbarrow.

7. A 2.5 kg sign is suspended from the ceiling using two cables that make angles of 23° and 30° with the ceiling. Calculate the tension in each cable.

8. Sally the Swimmer needs to swim from a point on the beach to a floating platform 50 m directly across from the shore. Sally can swim at a speed of 4 km/h in calm water. The lake has a 2 km/h current that runs parallel to the shore. If she wants to swim straight across to the dock, at what angle should she aim herself upstream before she starts swimming?

- 10. A flight leaves Pearson International Airport at 3:00 PM and travels 580 km/h [S50°W]. There is a constant wind blowing fromt 50 km/h [N28°E].
- a) What is the ground velocity of the airplane?

b) How far has the plane traveled at 3:30 PM?

A hanging sculpture is suspended using two cables. The first cable makes an angle of 80° to the ceiling and has a tension of 60 N. The second cable makes an angle of 75° to the ceiling. Determine the mass of the sculpture.

12. Determine the value of $\vec{a} + \vec{b}$ if $|\vec{3a}| = 24$ cm, $|\vec{2b}| = 10$ cm and $|\vec{3a} - \vec{2b}| = 20$.

3 Indicate whether the following are scalars or vectors.

- a) 40 km/h
- b) 10 km Northwest
- c) downward force of 12 N
- d) distance of the moon from Earth
- e) 100 km/h on a bearing of 230°





 $\underbrace{M}_{\overrightarrow{PM}} \text{ is the midpoint of line segment } PQ, \text{ and } R \text{ is the midpoint of } TS. If \\
\overrightarrow{PM} = \overrightarrow{MQ} = \overrightarrow{a} \text{ and } \overrightarrow{TR} = \overrightarrow{RS} = \overrightarrow{b}, \text{ as shown, prove that } 2\overrightarrow{RM} = \overrightarrow{TP} + \overrightarrow{SQ}.$





A steel wire 40 m long is suspended between two fixed points 20 m apart. A force of 375 N pulls the wire down at a point 15 m from one end of the wire. State the tension in each part of the wire.

A 25-kg restaurant sign hangs from a 1.25-m horizontal pole with one end fastened at right angles to the brick wall of a restaurant, and the other end fastened to a 2.5-m cable, as shown below. Determine the tension in the cable and the force counteracting the compression acting on the pole.





(23) Fir

Find the tension in each wire if the person weighs 60kg and the angle Θ is 30° .



A box sits on a frictionless ramp inclined at 25° to the horizontal. The force of gravity acting on the box perpendicular to the ground is 150 N.

a) Determine the static friction and normal forces that would keep the box from moving.

b) Determine the tension in a rope fastened to the middle of the top of the box that pulls the box at an angle of 45° relative to the top surface of the box and will keep the box from moving. What is the normal force now? Ignore friction for b

A pilot wishes to fly to an airfield $S20^{\circ} E$ of his present position. If the average airspeed of the plane is 520 km/h and the wind is from $N80^{\circ} E$ at 46 km/h,

- a. in what direction should the pilot steer?
- b. what will the plane's ground speed be?

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1. Draw the following vectors. Include a scale.

2. In the following diagram, state a pair of vectors that are:



Equal	AB = DC
Opposite	$\overrightarrow{AB} = -\overrightarrow{CD}$
Parallel, But Not Equal	DE II DB
Same Magnitude, But Not Parallel.	NONE

5



4. If
$$|\bar{a}| = 100 \text{ km} [N75^{\circ}E] \text{ and } |\bar{b}| = 85 \text{ km} [S10^{\circ}W], \text{ find } \bar{a} + \bar{b}.$$

$$a^{2} = b^{2} + c^{2} - 2bc \cos A$$

$$\frac{|\vec{a}+\vec{b}|^2 = |\vec{a}\cdot\vec{a} + \vec{b}|^2 = |\vec{a}\cdot\vec{a} + \vec{a}\cdot\vec{a} + \vec{b}|^2 = |\vec{a}\cdot\vec{a} + \vec{a}\cdot\vec{a} + \vec{a}\cdot$$

If $|\vec{a}| = 25$ cm, $|\vec{b}| = 10$ cm, and the two vectors make an angle of 65° , find: 5. $\vec{a} - \vec{b}$









20 + 36

20



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- - Scalar a) 40 km/h
 - b) 10 km Northwest vector
 - c) downward force of 12 N Jector
 - scalar distance of the moon from Earth d)
 - vector 100 km/h on a bearing of 230° e)



Use a diagram to explain how the vector

combination $\overrightarrow{CA} + \overrightarrow{BC} - \overrightarrow{DA}$ can be expressed as a single vector.



	$ \begin{array}{c} 2 \left(\overrightarrow{RT} + \overrightarrow{TP} + \overrightarrow{PM} \right) \\ 2 \left(-\overrightarrow{b} + \overrightarrow{TP} + \overrightarrow{a} \right) \end{array} $	TP + ST + TP + PQ $\partial TP - 2b + 2d$
b s	278-26+22	:: LS=RS

Suppose A, B, and C are three collinear points such that A divides CB the ratio 7 : 3. Suppose O is a point not on the line formed by A, B, and C. Prove that $\overrightarrow{OA} = \frac{7}{10} \overrightarrow{OB} + \frac{3}{10} \overrightarrow{OC}$.





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