4.6 Unit 4 Pretest Review – Geometric Vectors

This document was composed and formatted by Annie Bernatchez.

The course material originated from www.jensenmath.ca

This review covers all of Unit 4: Geometric Vectors, and is meant to be used to prepare for the unit test.

Section 1: 4.1 – Quadrant Bearings

1) Convert each true bearing to its equivalent quadrant bearing.

a) 159°	b) 064°	c) 280°	d) 202°

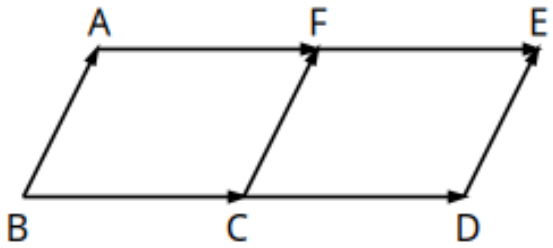
Section 2: 4.1 – Scale Vector Diagrams

2) Use an appropriate scale to draw each vector. Label the magnitude, direction, and scale.

a) a force of 120 N downward	b) a velocity of 85 km/h at a true bearing of 085°	c) a force of 8 N at a quadrant bearing of $N70°W$

Section 3: 4.1 – Equivalent Vectors

3) Name all the equivalent vectors in the diagram.



Copyright © 2026 Annie Bernatchez—All rights reserved.

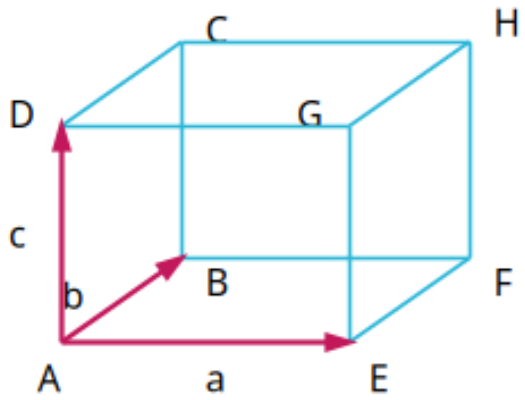
Section 4: 4.1 – Opposite Vectors

4) State the opposite of each vector.

a) 150 km/h on a quadrant bearing of $S50°W$	b) $\overrightarrow{AB}$
c) $\vec{v}$	d) 200 N upward

Section 5: 4.2 – Vector Sums and Differences in a Prism

5) The diagram shows a rectangular prism. Name the resulting vector that each sum or difference represents.

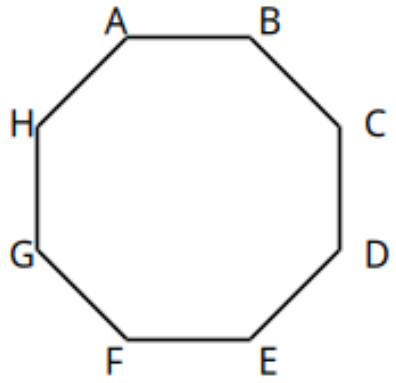


a) $\vec{a} + \vec{b} =$	b) $\vec{b} + \vec{c} =$
c) $\vec{a} - \vec{c} =$	d) $\vec{c} - \vec{b} =$
e) $\vec{c} - \vec{a} =$	f) $\vec{a} - \vec{b} =$

Copyright © 2026 Annie Bernatchez—All rights reserved.

Section 6: 4.2 – Vector Expressions in an Octagon

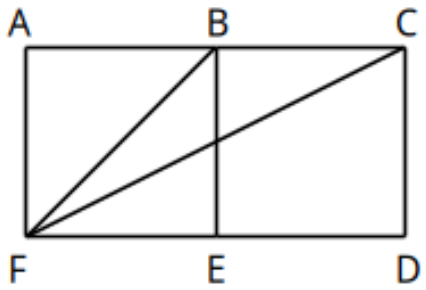
6) The diagram shows a regular octagon. Write a single vector that is equivalent to each vector expression.



a) $\overrightarrow{HA} + \overrightarrow{AB} =$	b) $\overrightarrow{GH} - \overrightarrow{GF} =$
c) $\overrightarrow{FE} + \overrightarrow{BA} =$	d) $\overrightarrow{GA} - \overrightarrow{EH} + \overrightarrow{DG} =$

Section 7: 4.2 – Vector Expressions in Two Squares

7) The diagram shows two squares. Name a single vector equivalent to each expression.

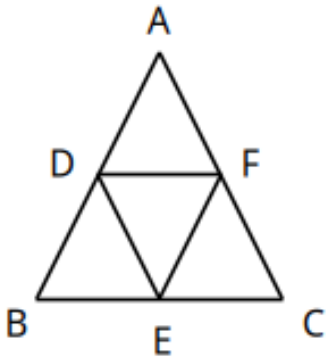


a) $\overrightarrow{FA} - \overrightarrow{FE} =$	b) $-\overrightarrow{EB} + \overrightarrow{EF} - \overrightarrow{AF} =$	c) $\overrightarrow{AE} + \overrightarrow{ED} - \overrightarrow{CD} =$

Copyright © 2026 Annie Bernatchez—All rights reserved.

Section 8: 4.2 – Midpoint Triangle Vector Expressions

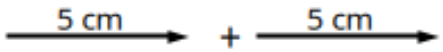
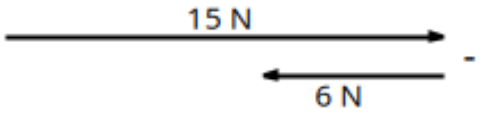
8) Equilateral triangle DEF joins the midpoints of equilateral triangle ABC. Write an expression that is equivalent to each single vector.



a) $\overrightarrow{AF}$ in terms of $\overrightarrow{AC}$	b) $\overrightarrow{AE}$ in terms of $\overrightarrow{AB}$ and $\overrightarrow{BC}$	c) $\overrightarrow{AB}$ in terms of $\overrightarrow{AF}$ and $\overrightarrow{EC}$

Section 9: 4.2 – Drawing Vector Sums and Differences

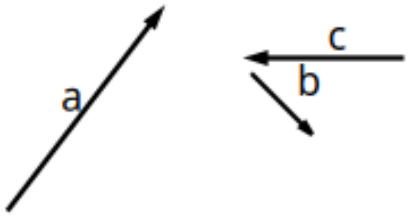
9) Draw a diagram to represent each vector sum or difference.

a)	b)
	

Copyright © 2026 Annie Bernatchez—All rights reserved.

Section 10: 4.2 – Drawing Combined Vector Expressions

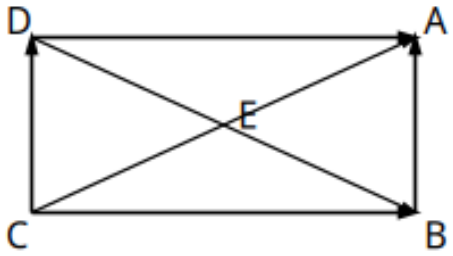
10) Use the following set of vectors to draw a diagram of each expression.



a) $\vec{a} + \vec{b} + \vec{c}$	b) $\vec{a} + \vec{b} - \vec{c}$	c) $\vec{a} - \vec{b} - \vec{c}$

Section 11: 4.2 – Parallelogram Diagonals

11) ABCD is a parallelogram, and E is the intersection point of the diagonals AC and BD. Name a single vector equivalent to each expression.



a) $\overrightarrow{AE} + \overrightarrow{EB} =$	b) $\overrightarrow{AE} + \overrightarrow{AE} =$
c) $\overrightarrow{BA} + \overrightarrow{AE} + \overrightarrow{ED} + \overrightarrow{DC} =$	d) $\overrightarrow{AB} - \overrightarrow{DB} =$
e) $\overrightarrow{AB} - \overrightarrow{CB} - \overrightarrow{DC} =$	

Section 12: 4.3 – Scalar Multiples Scale Diagram

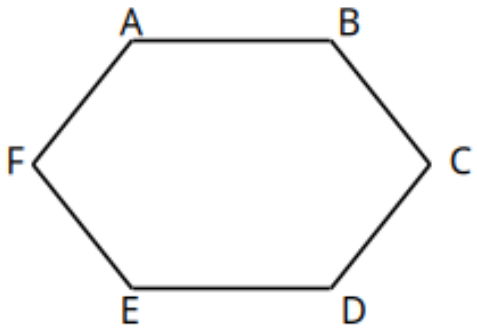
12) Let $|\vec{v}| = 500$ km/h, at a quadrant bearing of $S30°E$. Draw a scale diagram illustrating each related vector.

a) $2\vec{v}$	b) $0.4\vec{v}$	c) $-3\vec{v}$	d) $-5\vec{v}$

Copyright © 2026 Annie Bernatchez—All rights reserved.

Section 13: 4.3 – Hexagon Vector Expressions

13) In hexagon ABCDEF, opposite sides are parallel and equal, and $\overrightarrow{FC} = 2\overrightarrow{AB}$. Let $\overrightarrow{AB} = \vec{u}$ and $\overrightarrow{FA} = \vec{v}$. Express each vector in terms of $\vec{u}$ and $\vec{v}$.



a) $\overrightarrow{CF}$ =	b) $\overrightarrow{FB}$ =	c) $\overrightarrow{FD}$ =
d) $\overrightarrow{CA}$ =	e) $\overrightarrow{EB}$ =	f) $\overrightarrow{BE}$ =

Section 14: 4.2 – Magnitude of Vector Sum and Difference

14) The vectors $\vec{d}$ and $\vec{e}$ are such that $|\vec{d}| = 3$ and $|\vec{e}| = 5$, and the angle between them is 30°. Determine each of the following:

a) $\lvert\vec{d} + \vec{e}\rvert$	b) $\lvert\vec{d} - \vec{e}\rvert$

c) a unit vector in the direction of $\vec{d} + \vec{e}$

Section 15: 4.4 – Resultant of Two Forces

15) Given $|\overrightarrow{F_1}| = 85$ N and $|\overrightarrow{F_2}| = 125$ N and they are acting at an angle of 140° to each other…

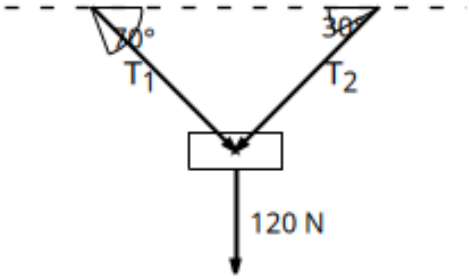
a) Find the magnitude of the resultant.

b) Describe the direction of $\overrightarrow{F_1} + \overrightarrow{F_2}$ relative to $\overrightarrow{F_1}$.

Copyright © 2026 Annie Bernatchez—All rights reserved.

Section 16: 4.4 – Tension: Sign on Two Chains

16) A 120 N sign is hanging from two chains attached to a ceiling as shown.



a) Draw the vector diagram that illustrates this situation.

b) Determine the magnitude of the tensions in the chains.

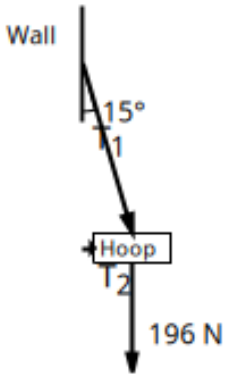
Section 17: 4.4 – Tension: Sign on a Single Chain

17) A sign weighing 98 N is suspended from the middle of a 4 m long chain. The ends of the chain are attached to a ceiling at points 3 m apart. Determine the tensions in the chains.

Copyright © 2026 Annie Bernatchez—All rights reserved.

Section 18: 4.4 – Tension: Basketball Hoop

18) A community center plans to install a new basketball hoop on the side of the building. The hoop and backboard have a combined weight of 196 N and are supported by a brace and a wire. Determine the magnitude of the tensions in the wire and the brace.



Section 19: 4.4 – Airplane Ground Velocity

19) An airplane is flying at 560 km/h on a heading of 340°. The wind is blowing at 140 km/h from the east.

a) Draw a vector diagram of this situation.

b) Determine the ground velocity of the airplane.

Section 20: 4.4 – Sailboat Navigation

20) A sailor wishes to sail to a port that is located $S25°E$ of his present position. The average speed of his sailboat is 23 knots and the wind is blowing from $N85°E$ at 12 knots.

a) Draw a vector diagram of this situation.

b) In which direction should the sailor sail?

Copyright © 2026 Annie Bernatchez—All rights reserved.

c) What will the sailboat's groundspeed be?

Section 21: 4.4 – Canoe River Crossing

21) A canoeist leaves a dock and paddles her canoe at an angle across a river. The current is flowing at 3 km/h. The resulting velocity of the boat is 5.4 km/h downstream, in a direction that forms a 15° angle with the adjacent shore.

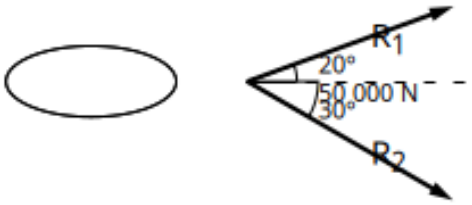
a) Draw a vector diagram of this situation.

b) Determine the canoeist's velocity relative to the water.

c) How far downstream will she be in 20 min?

Section 22: 4.4 – Cruise Ship Tow Ropes

22) A cruise ship is being pulled into a dock using two ropes, as shown in the diagram. Find the magnitude of the force in each rope if a resultant force of 50 000 N is needed to pull the cruise ship at the desired speed.



Section 23: 4.5 – Truck on a Ramp

23) A truck weighing 17 000 N is resting on a ramp that is inclined at an angle of 15° to the horizontal. Resolve the weight of the truck into the rectangular components keeping it at rest.

Copyright © 2026 Annie Bernatchez—All rights reserved.

Section 24: 4.5 – Dragging a Box up a Ramp

24) A rope attached to a box is being used to drag it up a ramp. A 130 N force is applied to the box at an angle of 35° to the ramp.

a) Find the magnitude of the force in the direction of motion of the box.

b) Find the magnitude of the force perpendicular to the direction of motion of the box.

Section 25: 4.4 – Resultant of Two Forces at an Angle

25) Suppose forces of 45 N and 70 N act at an angle of 110° to each other. Find the magnitude (to 1 decimal place) and direction (to the nearest degree) of the resultant force. State the direction as an angle off the 70 N force.

Section 26: 4.4 – Airplane Ground Velocity and Wind Speed

26) A plane is headed $N10°W$ with a speed of 600 km/h. An east wind (i.e. wind FROM the east towards the west) causes it to travel at $N16°W$. Find the resultant ground speed of the plane, and the speed of the wind, each to 1 decimal place.

Section 27: 4.5 – Resultant from Components

27) The force at which a tow truck pulls a car has a horizontal component of 20 000 N and a vertical component of 12 000 N. What is the resultant force on the car?

Section 28: 4.5 – Horizontal and Vertical Components

28) Determine the magnitude of the horizontal and vertical vector components of a 300 N force acting at an angle of 33° to the horizontal.

Copyright © 2026 Annie Bernatchez—All rights reserved.

Section 29: 4.5 – Box on a Frictionless Ramp

29) A box with a mass of 275 N rests on a frictionless ramp inclined at an angle of 25° to the level ground. What force must be applied to the box at an angle of 45° to the ramp so that it remains at rest?

Answer Key

1) a) $S21°E$ b) $N64°E$ c) $N80°W$ d) $S22°W$

3) $\overrightarrow{AE} = \overrightarrow{BD}$, $\overrightarrow{EA} = \overrightarrow{DB}$, $\overrightarrow{AF} = \overrightarrow{BC}$, $\overrightarrow{FA} = \overrightarrow{CB}$, $\overrightarrow{FE} = \overrightarrow{CD}$, $\overrightarrow{EF} = \overrightarrow{DC}$, $\overrightarrow{AB} = \overrightarrow{FC} = \overrightarrow{ED}$, $\overrightarrow{BA} = \overrightarrow{CF} = \overrightarrow{DE}$

4) a) 150 km/h $N50°E$ b) $-\overrightarrow{AB} = \overrightarrow{BA}$ c) $-\vec{v}$ d) 200 N downward

5) a) $\overrightarrow{AF}$ b) $\overrightarrow{AC}$ c) $\overrightarrow{DE}$ d) $\overrightarrow{BD}$ e) $\overrightarrow{ED}$ f) $\overrightarrow{BE}$

6) a) $\overrightarrow{HB}$ b) $\overrightarrow{FH}$ c) $\vec{0}$ d) $\vec{0}$

7) a) $\overrightarrow{EA}$ b) $\overrightarrow{BA}$ c) $\overrightarrow{AC}$

8) a) $0.5\overrightarrow{AC}$ b) $\overrightarrow{AB} + 0.5\overrightarrow{BC}$ c) $2\overrightarrow{AF} - 2\overrightarrow{EC}$

9) a) 10 cm b) 9 N

11) a) $\overrightarrow{AB}$ b) $\overrightarrow{AC}$ c) $\overrightarrow{BC}$ d) $\overrightarrow{AD}$ e) $\overrightarrow{AD}$

13) a) $-2\vec{u}$ b) $\vec{v} + \vec{u}$ c) $2\vec{u} - \vec{v}$ d) $-2\vec{u} + \vec{v}$ e) $2\vec{v}$ f) $-2\vec{v}$

14) a) $\sqrt{34 + 15\sqrt{3}} \approx 7.7$ units b) $\sqrt{34 - 15\sqrt{3}} \approx 2.83$ units c) $\frac{1}{\sqrt{34 + 15\sqrt{3}}}(\vec{d} + \vec{e})$

15) a) 81.1 N b) makes an angle of 97.6° with $\overrightarrow{F_1}$

16) b) $|\overrightarrow{T_1}| \approx 105.5$ N; $|\overrightarrow{T_2}| \approx 41.7$ N

17) 74.1 N

18) $|\overrightarrow{T_1}| \approx 202.9$ N $|\overrightarrow{T_2}| \approx 52.5$ N

19) b) 622 km/h at a bearing of 328°

20) b) $S54.4°E$ c) 15.9 knots

21) b) 2.6 km/h at an angle of 32.2° with the adjacent shore c) 1.7 km

22) $|\overrightarrow{R_1}| \approx 32\,635.2$ N $|\overrightarrow{R_2}| \approx 22\,323.8$ N

23) Force parallel to ramp: 4399.9 N, Normal force: 16 420.7 N

24) a) 106.5 N b) 74.6 N

25) 69.1 N at an angle of 37.7° with the 70 N force.

26) Magnitude of wind = 65.2 km/h, magnitude of ground speed = 614.7 km/h

27) 23 323.8 N at 31° above the horizontal

28) $|\overrightarrow{f_{horizontal}}| = 251.6$ N $|\overrightarrow{f_{vertical}}| = 163.4$ N

29) 164.36 N

Copyright © 2026 Annie Bernatchez—All rights reserved.