

Working with Vectors in the Plane

Grade 12 – Precalculus math · Test · Standards: N-VM.A.1, N-VM.A.2, N-VM.A.3, N-VM.B.4, N-VM.B.5

Name: _____ Date: _____ Class: _____

This 45-minute test has 8 questions worth 20 points. It covers components, magnitude, vector sums, unit vectors, the dot product, a current problem, equilibrium and perpendicular vectors. Show each step so partial credit can be awarded.

Standards: N-VM.A.1, N-VM.A.2, N-VM.A.3, N-VM.B.4, N-VM.B.5 · **Level:** Grade 12 Precalculus

Time: 45 minutes · 8 questions · Total: 20 points · Calculator: as allowed by your teacher

Question 1 Vector Between Points (2 points)

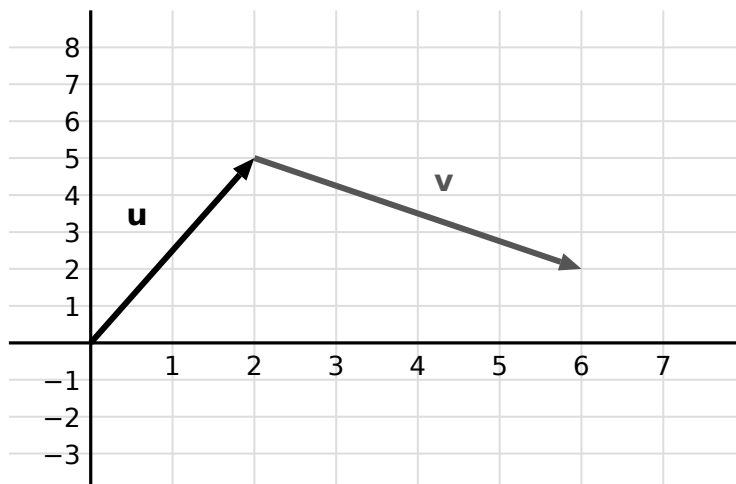
Find the vector from $P(-2, 6)$ to $Q(5, -1)$. (1 point) Then find its magnitude to the nearest hundredth. (1 point)

Question 2 Components from a Direction (2 points)

A vector has magnitude 40 and direction angle 125° . Find its horizontal component (1 point) and its vertical component (1 point) to the nearest hundredth.

Question 3 Vector Sum from a Figure (2 points)

The figure shows $\mathbf{u}$ from the origin to $(2, 5)$ and $\mathbf{v}$ drawn from the tip of $\mathbf{u}$ to the point $(6, 2)$.



Vectors $\mathbf{u}$ and $\mathbf{v}$ placed tip to tail.

- Read the components of $\mathbf{u}$ and $\mathbf{v}$ and find $\mathbf{u} + \mathbf{v}$. (1 point)
- Find $2\mathbf{u} - \mathbf{v}$. (1 point)

Question 4 Unit Vector (3 points)

Let $\mathbf{v} = \langle -3, 7 \rangle$. (a) Find the unit vector in the direction of $\mathbf{v}$. (1 point) (b) Show that its magnitude is 1. (1 point) (c) Find the vector of length 20 in the same direction, to the nearest hundredth. (1 point)

Question 5 Dot Product and Angle (3 points)

Let $\mathbf{u} = \langle 5, -2 \rangle$ and $\mathbf{v} = \langle 3, 5 \rangle$. (a) Find $\mathbf{u} \cdot \mathbf{v}$. (1 point) (b) Find $|\mathbf{u}|$ and $|\mathbf{v}|$. (1 point) (c) Find the angle between them to the nearest tenth of a degree. (1 point)

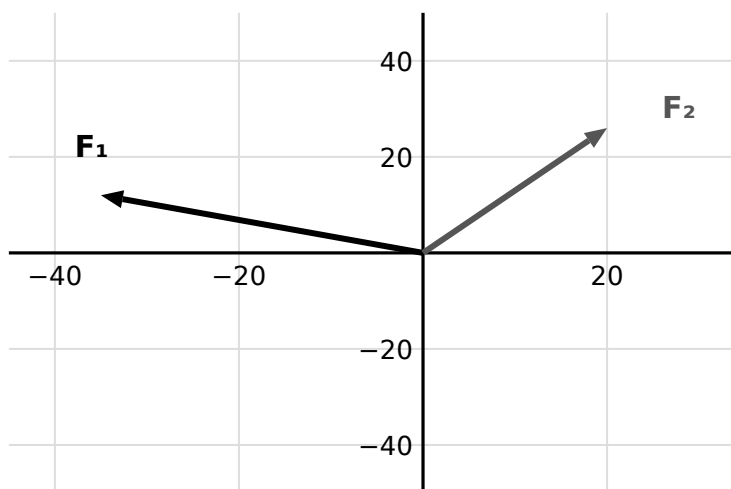
Question 6 Kayak in a Current (3 points)

A kayaker paddles straight across a river (north) at 5.5 mph while the current flows east at 1.8 mph.

- Write the resultant velocity vector. (1 point)
- Find the actual speed to the nearest hundredth. (1 point)
- Find the angle of the path east of north, to the nearest tenth of a degree. (1 point)

Question 7 Forces in Equilibrium (3 points)

Two forces act on a ring: $F_1 = \langle -35, 12 \rangle$ pounds and $F_2 = \langle 20, 26 \rangle$ pounds, as shown.



Forces F_1 and F_2 acting on a ring.

- a. Find the third force F_3 that puts the ring in equilibrium. (2 points)
- b. Find the magnitude of F_3 to the nearest tenth. (1 point)

Question 8 Perpendicular Vectors (2 points)

Find k so that $\langle k, -5 \rangle$ is perpendicular to $\langle 6, 4 \rangle$. Set up the condition first. (1 point) Then solve for k . (1 point)