

# Precalculus · Vectors in the Plane · Test Answer Key

Common Core N-VM.A.1, N-VM.A.2, N-VM.A.3, N-VM.B.4, N-VM.B.5 · mathovore.fr

This precalculus vectors test answer key gives the full solution and the scoring guide for each of the 9 test questions on vectors in the plane.

Use this answer key to grade the vectors test. Each solution shows full work, and the scoring note after it explains how every point is earned. Give partial credit only where the scoring note allows it; the maximum total is 20 points.

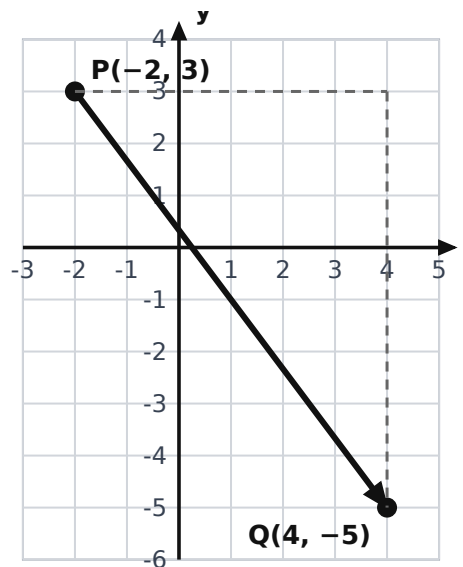
**Precalculus Common Core: N-VM.A.1 · N-VM.A.2 · N-VM.A.3 · N-VM.B.4 · N-VM.B.5**

## Precalculus Vectors Test Answer Key: questions 1-5

### Question 1: Components and magnitude (2 points)

- a.  $\langle 6, -8 \rangle$  ( $4 - (-2) = 6$ ,  $-5 - 3 = -8$ )
- b.  $\sqrt{36 + 64} = 10$

*Scoring: 1 point for each correct part; subtracting the coordinates in the wrong order earns 0 for part (a).*



Legs 6 and 8, hypotenuse 10.

### Question 2: Magnitude and direction (2 points)

- a.  $\sqrt{9+27} = \sqrt{36} = 6$
- b.  $\tan \theta = \frac{3\sqrt{3}}{-3} = -\sqrt{3}$ , reference angle  $60^\circ$ , quadrant II:  $\theta = 120^\circ$

Scoring: 1 point for each part; for part (b) award the point only if the angle is in the correct quadrant ( $60^\circ$  earns 0).

### Question 3: Combining vectors (2 points)

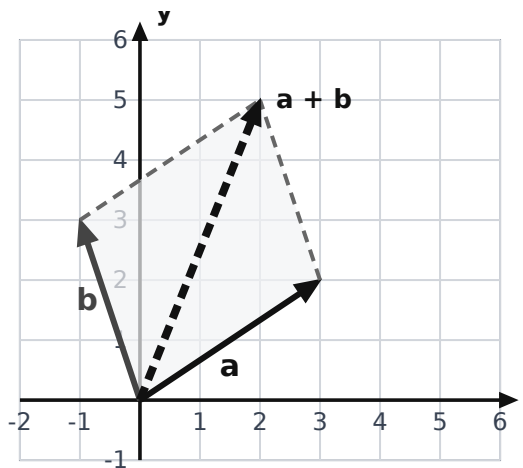
- a.  $\langle 6-8, -15+6 \rangle = \langle -2, -9 \rangle$
- b.  $\langle 2+8, -5-6 \rangle = \langle 10, -11 \rangle$

Scoring: 1 point for each correct vector; 0 for a part with a sign error in the subtraction.

### Question 4: Parallelogram rule (3 points)

- a.  $\vec{a} = \langle 3, 2 \rangle$ ,  $\vec{b} = \langle -1, 3 \rangle$ , so  $\vec{a} + \vec{b} = \langle 2, 5 \rangle$
- b.  $\vec{a} - \vec{b} = \langle 4, -1 \rangle$
- c.  $\sqrt{4+25} = \sqrt{29}$

Scoring: 1 point per part. In part (a) the point requires correct components for both vectors and the sum.



The diagonal is  $\mathbf{a} + \mathbf{b}$ .

### Question 5: Unit vector (2 points)

- a.  $\sqrt{81+144} = 15$
- b.  $\frac{1}{15}\langle -9, 12 \rangle = \langle -\frac{3}{5}, \frac{4}{5} \rangle$

Scoring: 1 point per part; part (b) requires dividing every component by the magnitude.

## Precalculus Vectors Test Answer Key: questions 6-9

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### Question 6: Dot product and angle (3 points)

- a.  $2(-1) + 4(3) = 10$
- b.  $|\vec{u}| = \sqrt{20} = 2\sqrt{5}$  and  $|\vec{v}| = \sqrt{10}$
- c.  $\cos\theta = \frac{10}{\sqrt{20}\sqrt{10}} = \frac{10}{\sqrt{200}} = \frac{\sqrt{2}}{2}$ , so  $\theta = 45^\circ$

Scoring: 1 point per part.

### Question 7: Perpendicular vectors (2 points)

Perpendicular means dot product 0:  $10k - 20 = 0$  (1 point), so  $k = 2$ . Check:  
 $\langle 2, 5 \rangle \cdot \langle 10, -4 \rangle = 20 - 20 = 0$ .

Scoring: 1 point for the equation, 1 point for the value and the check.

### Question 8: Airplane and wind (2 points)

Ground velocity  $\langle 70, 240 \rangle$ , speed  $\sqrt{4900 + 57600} = \sqrt{62500} = \mathbf{250 \text{ mph}}$  (1 point).

Direction:  $\tan^{-1}\left(\frac{70}{240}\right) \approx 16.3^\circ$  east of north (1 point).

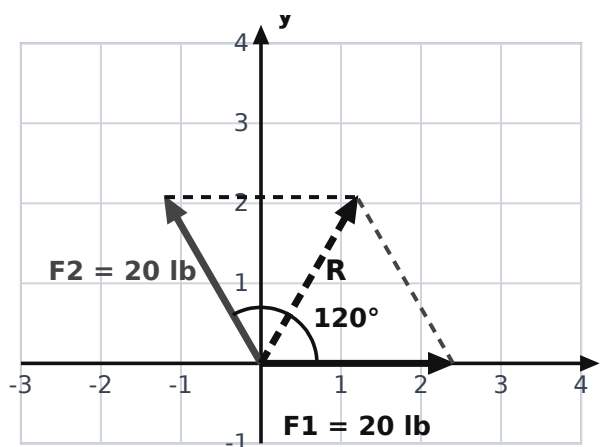
Scoring: 1 point for the speed, 1 point for the angle.

### Question 9: Two forces (2 points)

$\vec{F}_1 = \langle 20, 0 \rangle$ ,  $\vec{F}_2 = \langle 20\cos 120^\circ, 20\sin 120^\circ \rangle = \langle -10, 10\sqrt{3} \rangle$  (1 point).

Resultant  $\langle 10, 10\sqrt{3} \rangle$ , magnitude  $\sqrt{100 + 300} = \mathbf{20 \text{ pounds}}$ , direction  $\tan^{-1}(\sqrt{3}) = 60^\circ$  (1 point).

Scoring: 1 point for the components and sum, 1 point for magnitude and direction.



The resultant R bisects the angle between the two equal forces.

## Scoring summary

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|                                                                                                 |
|-------------------------------------------------------------------------------------------------|
| <b>Total</b>                                                                                    |
| <b>20 points:</b> add the points of every question of this precalculus vectors test answer key. |

## How to use this precalculus vectors test answer key

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Use this precalculus vectors test answer key to score the test fairly and to see which skills need more practice.

