

AP Precalculus
Velocity Vector Applications

Velocity Vector Applications | APPC-U04-P12

96 problems · Four activity formats

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Topic focus
Across 96 tasks this topic asks for elapsed time and endpoint, required component and impossibility proof, final coordinates, exact coordinates, displacement and exact path length and net displacement and exact distance.
8 PDFs and a README; 123 buyer pages.

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Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. A value without its unit is not a complete answer.

An aircraft flies due east at $120 \frac{km}{h}$ relative to the air while a $50 \frac{km}{h}$ wind blows due north. Find its ground velocity, speed, and course. Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition or evidence	Supplied value
Air velocity ($\frac{km}{h}$)	$\langle 120, 0 \rangle$
Coordinate convention	east-north
Given context	aircraft motion
Wind velocity ($\frac{km}{h}$)	$\langle 0, 50 \rangle$

Bank label: _____

A boat covers displacement $\langle 24, 8 \rangle km$ in 2 hours while its water-relative velocity is $\langle 10, 1 \rangle \frac{km}{h}$. Assuming a constant current, find it.

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition or evidence	Supplied value
Coordinate convention	east-north
Boat velocity relative water ($\frac{km}{h}$)	$\langle 10, 1 \rangle$
Given context	boat and current
Duration (hours)	2
Observed displacement (km)	$\langle 24, 8 \rangle$

Bank label: _____

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Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. A value without its unit is not a complete answer.

A plane flies at airspeed $200 \frac{\text{km}}{\text{h}}$ on heading $N30^\circ E$ while the wind is $\langle -40, 20 \rangle \frac{\text{km}}{\text{h}}$. Find the ground velocity and approximate ground course.

Show a complete response in the numbered workspace, preserving requested exactness, units, interval endpoints, and justification.

Condition or evidence	Supplied value
Airspeed ($\frac{\text{km}}{\text{h}}$)	200
Coordinate convention	east-north
Given context	aircraft navigation
Heading	$N30^\circ E$
Wind ($\frac{\text{km}}{\text{h}}$)	$\langle -40, 20 \rangle$

A person walks at $\langle 1, 2 \rangle \frac{\text{m}}{\text{s}}$ relative to a walkway moving at $\langle 3, 0 \rangle \frac{\text{m}}{\text{s}}$ relative to the floor. Describe the person's ground motion.

Show a complete response in the numbered workspace, preserving requested exactness, units, interval endpoints, and justification.

Condition or evidence	Supplied value
Coordinate convention	forward-left
Given context	person on moving walkway
Person velocity relative walkway ($\frac{\text{m}}{\text{s}}$)	$\langle 1, 2 \rangle$
Walkway velocity relative ground ($\frac{\text{m}}{\text{s}}$)	$\langle 3, 0 \rangle$

Infer the current independently from each observation row and decide whether the constant-current model is supported.

Show a complete response in the numbered workspace, preserving requested exactness, units, interval endpoints, and justification.

interval	duration h	displacement km
1	2	$\langle 12, 6 \rangle$
2	0.5	$\langle 3, 1.5 \rangle$

Condition or evidence	Supplied value
Coordinate convention	east-north
Boat velocity relative water ($\frac{\text{km}}{\text{h}}$)	$\langle 8, 0 \rangle$
Given context	repeated boat observations

Convert every duration to seconds before using the velocity table. Then find displacement and distance.

Show a complete response in the numbered workspace, preserving requested exactness, units, interval endpoints, and justification.

stage	duration	velocity
1	30s	$\langle 2, 0 \rangle$
2	1 min	$\langle 0, 1 \rangle$
3	0.5 min	$\langle -1, 0 \rangle$

Condition or evidence	Supplied value
Given context	stages with mixed time units
Velocity unit	$\frac{\text{m}}{\text{s}}$

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Begin at START. Answer the card, then find the matching final answer at the top of another card. Use the recording sheet for your reasoning. Visit each card once and continue to FINISH.

Incoming: The stage displacements sum to $\langle 0, 4 \rangle$ km, whose magnitude is 4 km; the total distance is 20 km.

Find the current that changes water-relative velocity $\langle 10, 0 \rangle \frac{m}{s}$ into ground velocity $\langle 6, 8 \rangle \frac{m}{s}$.

Solve the card, use the complete requested response as the outgoing match, and move to the unique card whose incoming header matches it; continue until FINISH.

Condition or evidence	Supplied value
Coordinate convention	east-north
Boat velocity relative water ($\frac{m}{s}$)	$\langle 10, 0 \rangle$
Given context	boat velocity frames
Ground velocity ($\frac{m}{s}$)	$\langle 6, 8 \rangle$

Your response: _____

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Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

A student adds the two perpendicular speeds as scalars. Explain the error and correct the ground-speed calculation.

Identify the error or first invalid step, give the corrected result, and state a brief mathematical reason.

Condition or evidence	Supplied value
Coordinate convention	east-north
Given context	drone in wind
Drone air velocity ($\frac{m}{s}$)	$\langle 40, 0 \rangle$
Student claim to examine	The ground speed is $40 + 30 = 70 \frac{m}{s}$.
Wind ($\frac{m}{s}$)	$\langle 0, 30 \rangle$

Infer the current from the two velocities and decide whether it can be due east as claimed.

Identify the error or first invalid step, give the corrected result, and state a brief mathematical reason.

Condition or evidence	Supplied value
Coordinate convention	east-north
Boat velocity relative water ($\frac{m}{s}$)	$\langle 3, 4 \rangle$
Claimed current direction to test	due east
Given context	boat observation with directional assumption
Ground velocity ($\frac{m}{s}$)	$\langle 8, 5 \rangle$

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Full Worked Solutions - excerpt

Worked example

Problem. The velocity does not change between the two table rows. Find displacement and distance after all 5 minutes. Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Duration (min)	Given velocity (m/min)	Condition or evidence	Supplied value
2	$\langle 3, 0 \rangle$	Given context	collinear stages
3	$\langle 3, 0 \rangle$	Units	Time min Given velocity m/min

Answer. The displacement is $\langle 15, 0 \rangle$ m and the distance is 15 m.

Explanation and check.

The durations combine because the velocity is unchanged, so $5 \langle 3, 0 \rangle$ gives the entire trip.

Worked example

Problem. Find the one-vector displacement and the scalar path length for the three stages.

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Duration (s)	Given velocity (m/s)	Condition or evidence	Supplied value
2	$\langle 4, 0 \rangle$	Given context	three-sided path
1	$\langle 0, 3 \rangle$	Units	Time s Given velocity $\frac{m}{s}$
1	$\langle -4, 0 \rangle$		

Answer. The net displacement is $\langle 4, 3 \rangle$ m, and the distance is 15 m.

Explanation and check.

The displacements $\langle 8, 0 \rangle$, $\langle 0, 3 \rangle$, and $\langle -4, 0 \rangle$ add to the net; their lengths add to 15.