1. **Question Details**

The \( x \) component of vector \( \vec{R} \) is \( R_x = -23.2 \) units and its \( y \) component is \( R_y = 29.2 \) units. What are its magnitude and direction? Give the direction as an angle measured counterclockwise from the +\( x \) direction.

- **Magnitude**: \( 37.3 \) units
- **Direction**: \( 128^\circ \) counterclockwise from the +\( x \)-axis

**Supporting Materials**

- **Physical Constants**

2. **Question Details**

If an airplane travels \( 21.0^\circ \) north of east for \( 260 \) km, how far east and how far north did it travel? In other words, what are the magnitudes of the east component and north component of the plane’s displacement?

- **(a) East component**: \( 243 \) km
- **(b) North component**: \( 93.2 \) km

**Supporting Materials**

- **Physical Constants**

3. **Question Details**

A cheetah is running at a speed of \( 17.7 \) m/s in a direction of \( 48^\circ \) north of west. Find the components of the cheetah’s velocity along the following directions.

- **(a) The velocity component due north**: \( 13.2 \) m/s
- **(b) The velocity component due west**: \( 11.8 \) m/s

**Supporting Materials**

- **Physical Constants**

4. **Question Details**

Two position vectors lie in a plane. The first, vector \( \vec{R}_A \) points at an angle of \( 20^\circ \) below the positive \( x \)-axis and has a magnitude of \( 51.0 \) m. The second, vector \( \vec{R}_B \) points at an angle of \( 59.5^\circ \) above the positive \( x \)-axis and has a magnitude of \( 75 \) m.

(a) Choose the diagram below that is correct a graphical representation of \( \vec{R}_A + \vec{R}_B \)

(b) What is the magnitude and direction of vector \( \vec{R}_A + \vec{R}_B \)? Give the direction as an angle measured counterclockwise from the positive \( x \)-axis?

- **Magnitude**: \( 98.1 \) m
- **Direction**: \( 28.8^\circ \) (counterclockwise from the +\( x \)-axis)

**Supporting Materials**

- **Physical Constants**
5. Question Details

A child walking in a field makes three consecutive displacements. The child first moves 6.20 m westward, then 12.7 m northward. Finally, the child moves back to starting point of the first displacement. What is the magnitude and direction of the child's third displacement? Give the direction as an angle south of east.

- **Magnitude**: 14.1 m
- **Direction**: 64° south of east

Physical Constants

6. Question Details

The figure below shows four position vectors, \( \vec{A} \), \( \vec{B} \), \( \vec{C} \), and \( \vec{D} \). Their directions are given in the figure, and their magnitudes are the following:

- \( A = 42 \text{ m} \)
- \( B = 56 \text{ m} \)
- \( C = 28 \text{ m} \)
- \( D = 42 \text{ m} \).

If the vector \( \vec{R} = \vec{A} + \vec{B} + \vec{C} + \vec{D} \), what are the \( x \) and \( y \) components of \( \vec{R} \)?

- \( R_x = 59.7 \text{ m} \)
- \( R_y = 62.6 \text{ m} \)

Physical Constants

7. Question Details

Two position vectors, \( \vec{A} \) and \( \vec{B} \), are shown in the diagram below. The green arrow represents vector \( \vec{A} \) while the red one represents \( \vec{B} \). The components of the vectors are as follows:

- \( A_x = -7 \text{ cm} \), \( A_y = -19 \text{ cm} \)
- \( B_x = 18 \text{ cm} \), \( B_y = -7 \text{ cm} \).

For each of the given expressions, calculate the magnitude of the resultant vector, and select the diagram that is the best graphical (tail-to-head method) representation of the vectors and the resultant.

For each of the given expressions, calculate the magnitude of the resultant vector, and select the diagram that is the best graphical (tail-to-head method) representation of the vectors and the resultant.

- \( \vec{C} = \vec{A} + \vec{B} \)
- \( \vec{C} = 28.2 \text{ cm} \)
While in a park, you walk west for 52 m, then you walk 33.1° north of west for 41 m, and finally you walk due north for 25 m. Find the components of your final displacement, from your initial to final point, along the north and west directions.

(a) displacement component due north

47.4 m

(b) displacement component due west

86.3 m

A new landowner has a triangular piece of flat land she wishes to fence. Starting at the west corner, she measures the first side to be 80 m long and the next to be 105 m — these sides are represented as displacement vectors \( \vec{A} \) and \( \vec{B} \) in Figure 3.26, where \( \theta_1=23^\circ \), and \( \theta_2=12^\circ \). She then correctly calculates the length and orientation of the third side \( \vec{C} \). What is her result?

88.3 m

54.1° south of west

A 68-kg man stands on a bathroom scale inside an elevator.

(a) The elevator accelerates upward from rest at a rate of 1.15 m/s² for 1.50 s. What does the scale read during this 1.50 s interval?

745 N

(b) The elevator continues upward at constant velocity for 8.50 s. What does the scale read now?

666 N

(c) While still moving upward, the elevator's speed decreases at a rate of 0.400 m/s² for 3.00 s. What is the scale reading during this time?

639 N
A contestant in a winter games event pushes a 50.0-kg rock across a frozen lake with a force of 25 N at 26° below the horizontal as shown in Figure (a) below, and it moves with an acceleration of 0.45 m/s² to the right.

(a) What is the normal force exerted by the lake surface on the rock?

\[
\text{Normal force} = 501 \text{ N}
\]

(b) Instead of pushing on the rock, the contestant now pulls on it with a rope over his shoulder at the same angle above the horizontal as in part (a). See Figure (b) above. Now what is the normal force exerted by the lake surface on the rock?

\[
\text{Normal force} = 479 \text{ N}
\]

The three diagrams below show a block of mass \( m \) being pulled or pushed at constant velocity along a table with a force \( F \). Assume the surfaces to be frictionless.

(a) What is the magnitude of the normal force in each case? Use the following as necessary: \( g \), \( P \), and \( \theta \).

- case (i) \( F = mg \)
- case (ii) \( F = mg + P \sin(\theta) \)
- case (iii) \( F = mg \cos(\theta) \)

(b) How would your answer to part (a) change if, all else being the same, the object moved with constant acceleration?

- The normal force will increase.
- The normal force will decrease.
- The normal force will remain the same.

Supporting Materials

Physical Constants
13. **Question Details**

Tom enlists the help of his friend John to move his car. They apply forces to the car as shown in the diagram. Here

\[ F_1 = 431 \text{ N} \] and \[ F_2 = 340 \text{ N} \] and friction is negligible. In the diagram below, the mass of the car = 3500 kg, \( \theta_1 = -25^\circ \) and \( \theta_2 = 12^\circ \). (Assume the car faces the positive \( x \)-axis before the forces are applied.)

(a) Find the resultant force exerted on the car.

- **Magnitude:** 732 N
- **Direction:** -8.76° (counterclockwise from the +x-axis)

(b) What is the acceleration of the car?

- **Magnitude:** 0.209 m/s²
- **Direction:** -8.76° (counterclockwise from the +x-axis)

**Supporting Materials**

- Physical Constants

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14. **Question Details**

The figure below shows Superhero hanging motionless from a rope, with Trusty Sidekick hanging below him. Superhero's mass is 87.0 kg, while Trusty Sidekick's is 52.5 kg, and the mass of the rope is negligible.

(a) Find the tension in the rope at a point between Superhero and Trusty Sidekick.

- **Tension:** 515 N

(b) Find the tension in the rope at a point above Superhero.

- **Tension:** 1370 N

**Supporting Materials**

- Physical Constants
Consider the following figure. (Let $m_1$ be the mass of the child, and $m_2$ be the mass of the scale.)

(a) Which of the following diagrams correctly represents the free body diagram for the child?

(b) What is the mass of the child and basket if a scale reading of 104 N is observed?

(c) What is the tension $T_1$ in the cord attaching the child to the scale? (Enter the magnitude only.)

(d) What is the tension $T_2$ in the cord attaching the scale to the ceiling, if the scale has a mass of 0.800 kg? (Enter the magnitude only.)
A 17.6-kg traffic light is suspended from two cables as shown in the figure below. Find the tension in each cable.

Supporting Materials

Physical Constants

Assignment Details

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