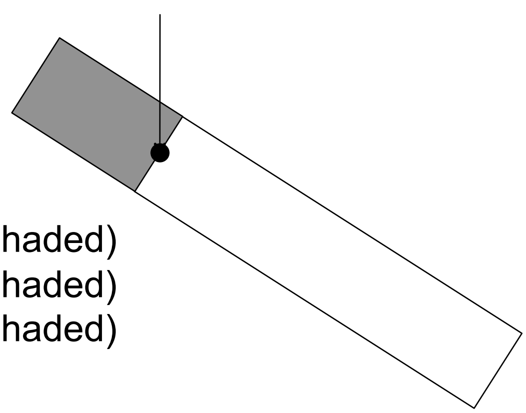
Which of the three quantities:
$\mathbf{R}_{CM}$, $\mathbf{v}_{CM}$ ($=d\mathbf{R}_{CM}/dt$), or $\mathbf{a}_{CM}$ ($= d^2\mathbf{R}_{CM}/dt^2$)
*depends* on your choice of origin?

A) All three depend
B) $\mathbf{R}_{CM}$, $\mathbf{v}_{CM}$ depend (but $\mathbf{a}_{CM}$ does not)
C) $\mathbf{R}_{CM}$ depends (but $\mathbf{v}_{CM}$ and $\mathbf{a}_{CM}$ do not)
D) NONE of them depend
E) Something else/not sure...

1

The dark shaded portion of this rigid body is a different material from the light shaded portion. The object is hanging from the black “pivot point”, and is in balance and stationary. (Ignore friction!)

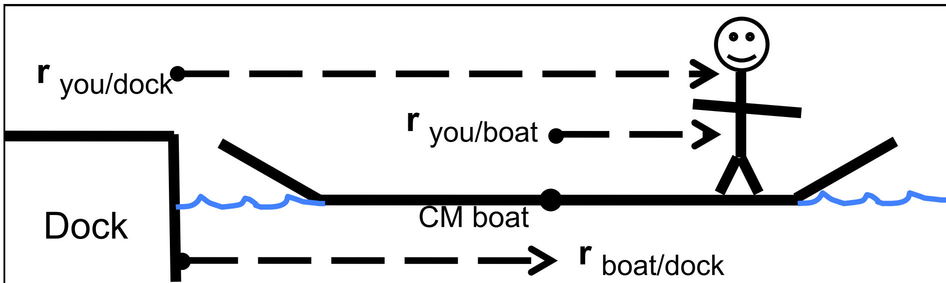


Compare the mass of the shaded and unshaded portions:

A) M(shaded) > M(unshaded)
B) M(shaded) = M(unshaded)
C) M(shaded) < M(unshaded)
D) Not enough info!

To think about: Where is the CM of this object?

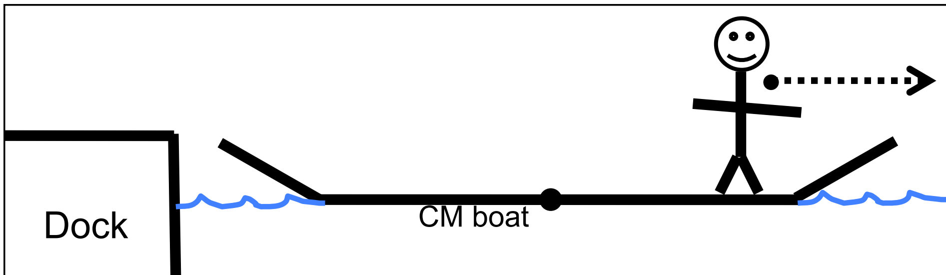
2




You are walking on a flat-bottomed rowboat.
Which formula correctly relates position vectors?
Notation: $\mathbf{r}_{a/b}$ is "position of a with respect to b."

A) $\mathbf{r}_{you/dock} = \mathbf{r}_{you/boat} + \mathbf{r}_{boat/dock}$
B) $\mathbf{r}_{you/dock} = \mathbf{r}_{you/boat} - \mathbf{r}_{boat/dock}$
C) $\mathbf{r}_{you/dock} = -\mathbf{r}_{you/boat} + \mathbf{r}_{boat/dock}$
D) $\mathbf{r}_{you/dock} = -\mathbf{r}_{you/boat} - \mathbf{r}_{boat/dock}$
E) Other/not sure

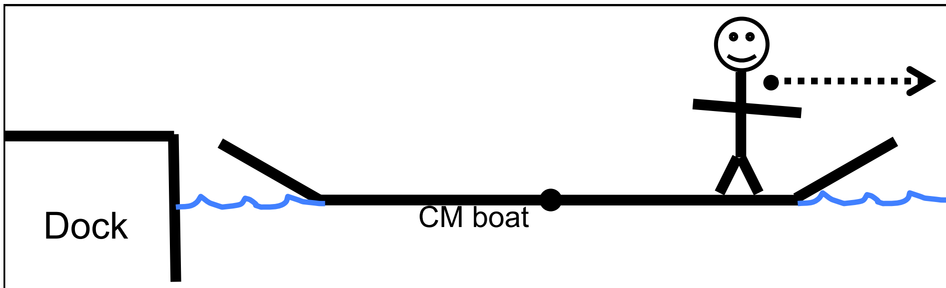
3




You are walking on a flat-bottomed rowboat.
Which formula correctly relates velocities?
Notation: $\mathbf{v}_{a/b}$ is "velocity of a with respect to b."

A) $\mathbf{v}_{you/dock} = \mathbf{v}_{you/boat} + \mathbf{v}_{boat/dock}$
B) $\mathbf{v}_{you/dock} = \mathbf{v}_{you/boat} - \mathbf{v}_{boat/dock}$
C) $\mathbf{v}_{you/dock} = -\mathbf{v}_{you/boat} + \mathbf{v}_{boat/dock}$
D) $\mathbf{v}_{you/dock} = -\mathbf{v}_{you/boat} - \mathbf{v}_{boat/dock}$
E) Other/not sure

4

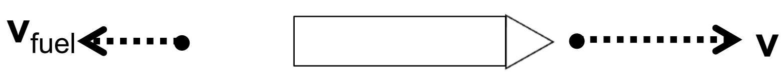



If you are walking in the boat at what feels to you to be your normal walking pace, $\mathbf{v_0}$, WHICH of these symbols equals $\mathbf{v_0}$?

A) $\mathbf{v}_{you/dock}$ B) $\mathbf{v}_{you/boat}$ C) $\mathbf{v}_{boat/dock}$

D) NONE of these...






A rocket travels with velocity $\mathbf{v}$ with respect to an (inertial) NASA observer.

It ejects fuel at velocity $\mathbf{v}_{exh}$ *in its own reference frame.* Which formula correctly relates these two velocities with the velocity $\mathbf{v}_{fuel}$ of a chunk of ejected fuel with respect to an (inertial) NASA observer?

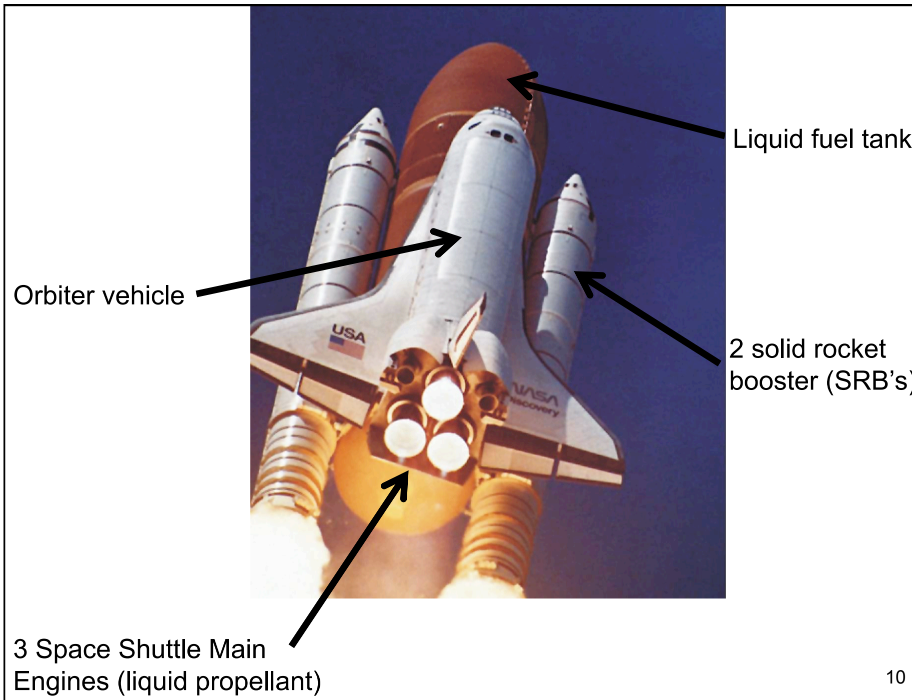
A) $\mathbf{v} = \mathbf{v}_{fuel} + \mathbf{v}_{exh}$

B) $\mathbf{v} = \mathbf{v}_{fuel} - \mathbf{v}_{exh}$

C) $\mathbf{v} = -\mathbf{v}_{fuel} + \mathbf{v}_{exh}$

D) $\mathbf{v} = -\mathbf{v}_{fuel} - \mathbf{v}_{exh}$

E) Other/not sure??




10

You have TWO medicine balls on a cart, and toss the first.
Your speed will increase by $\Delta v_1$.
Now you're moving, and you toss #2 (in the same way).
How does the second increase in speed, $\Delta v_2$, compare to the first one?

A) $\Delta v_2 = \Delta v_1$
B) $\Delta v_2 > \Delta v_1$
C) $\Delta v_2 < \Delta v_1$
D) ??

12

Which of the three quantities:
**τ** (torque), **L** (angular momentum), or
**p** (linear momentum)
*depends* on your choice of origin?

A) All three depend
B) **τ** depends (but **L** and **p** do not)
C) **L** depends (but **τ** and **p** do not)
D) NONE of them depend
E) Something else/not sure...

13

The vector **A** is in the xy plane.
**B** is parallel to the z-axis.
Which is true about **P** **=A** x **B**?

A) **P** is perpendicular to the xy plane
B) **P** lies in the xy plane
C) $P_x=0$
D) $P_y=0$
E) None of the above is always true.

14

Given a particle with mass m, velocity $\vec{v}$, $\vec{p} = m\vec{v}$, and $\vec{L} = \vec{r} \times \vec{p}$, what is $\vec{L} \cdot \vec{p}$ ?

A) zero
B) a non-zero scalar
C) a vector, parallel to **p**
D) a vector, perpendicular to **p**
E) Need more info!

15