Key

Science 10

Worksheet – Acceleration Problems

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

1. A skater increases her velocity from 2.0 m/s to 10.0 m/s in 3.0 seconds. What is the skater's acceleration? (2.7 m/s^2)

2. While traveling along a highway, a driver slows from 24 m/s west to 15 m/s west in 12 s. What is the automobile's acceleration? (0.75 m/s^2 east)

3. A skateboarder traveling at 7.0 m/s rolls to a stop at the top of a ramp in 3.0 s. What is the skateboarder's acceleration? (2.3 m/s^2 down the ramp)

4. A car accelerates at a rate of 3.0 m/s^2 east. If its original velocity is 8.0 m/s east, how long will it take the car to reach a final velocity of 25.0 m/s east? (5.7 s)

5. A cart rolling down an incline for 5.0 seconds has an acceleration of -4.0 m/s^2. If the cart has a beginning velocity of -2.0 m/s, what is its final velocity? (-22 m/s)

6. A car traveling at a velocity of 30.0 m/s encounters an emergency and comes to a complete stop. How much time will it take for the car to stop if it slows at a rate of -4.0 m/s^2? (7.5 s)

7. Josh rolled a bowling ball down a lane. The ball traveled at a constant acceleration of 1.8 m/s^2 and was traveling with a velocity of 7.6 m/s by the time it reached the pins at the end of the lane. What was the initial velocity of the ball when it left Josh's hand if it took the ball 2.5 s to reach the pins? ~~(2.5 m/s)~~ 3.1 m/s

* Assume objects are moving to the right unless otherwise stated.

1. $\vec{v}_i = +2.0\ m/s$
$\vec{v}_f = +10.0\ m/s$
$t = 3.0\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

$$\vec{a} = \frac{+10.0\ \frac{m}{s} - (+2.0\ \frac{m}{s})}{3.0\ s}$$

$$\vec{a} = +2.7\ m/s^2$$

The acceleration is $2.7\ m/s^2$, right.

2. $\vec{v}_i = -24\ m/s$
$\vec{v}_f = -15\ m/s$
$t = 12\ s$
$\vec{a} = ?$

(- west)

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

$$\vec{a} = \frac{-15\ \frac{m}{s} - (-24\ \frac{m}{s})}{12\ s}$$

$$\vec{a} = +0.75\ m/s^2$$

The acceleration is $0.75\ m/s^2$, east.

3.

$\vec{v}_i = +7.0\ m/s$
$\vec{v}_f = 0\ m/s$
$t = 3.0\ s$
$\vec{a} = ?$

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

$$\vec{a} = \frac{0\ \frac{m}{s} - (+7.0\ \frac{m}{s})}{3.0\ s}$$

$$\vec{a} = -2.3\ m/s^2$$

The acceleration is $2.3\ m/s^2$ down the ramp.

4. $\vec{a} = +3.0 \frac{m}{s^2}$

$\vec{v}_i = +8.0 m/s$

$\vec{v}_f = +25.0 m/s$

$t = ?$

+ east.

$\vec{v}_f = \vec{v}_i + \vec{a}t$

$\vec{v}_f - \vec{v}_i = \vec{a}t$

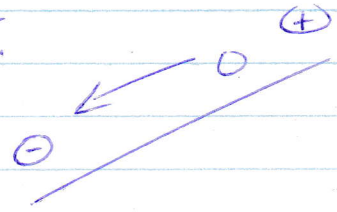
$\frac{\vec{v}_f - \vec{v}_i}{\vec{a}} = \frac{\vec{a}t}{\vec{a}}$

$t = \frac{\left(+25.0 \frac{m}{s} - \left(+8.0 \frac{m}{s}\right)\right)}{+3.0 m/s^2}$

$t = 5.7 s$

It will take 5.7 s.

5.



$t = 5.0 s$

$\vec{a} = -4.0 m/s^2$

$\vec{v}_i = -2.0 m/s$

$\vec{v}_f = ?$

$\vec{v}_f = \vec{v}_i + \vec{a}t$

$\vec{v}_f = \left(-2.0 \frac{m}{s}\right) + \left(-4.0 \frac{m}{s^2}\right)(5.0 s)$

$\vec{v}_f = -22 \frac{m}{s}$

Its final velocity is 22 m/s. down the ramp.

6. 0 →

$\vec{v}_i = +30.0 m/s$

$\vec{v}_f = 0 m/s$

$t = ?$

$\vec{a} = -4.0 m/s^2$

$\vec{v}_f = \vec{v}_i + \vec{a}t$

$0 = \vec{v}_i + \vec{a}t$

$-\vec{v}_i = \vec{a}t$

$\frac{-\vec{v}_i}{\vec{a}} = \frac{\vec{a}t}{\vec{a}}$

$t = \frac{-(30.0 m/s)}{-4.0 m/s^2}$

$t = 7.5 s$

It will take the car 7.5 s to stop.

7.

$\vec{v}_i = ?$

$\vec{a} = +1.8 \text{ m/s}^2$

$\vec{v}_f = +7.6 \text{ m/s}$

$t = 2.5 \text{ s}$

$\vec{v}_f = \vec{v}_i + \vec{a}t$

$\vec{v}_f - \vec{a}t = \vec{v}_i$

$\vec{v}_i = +7.6 \frac{\text{m}}{\text{s}} - \left(+1.8 \frac{\text{m}}{\text{s}\cancel{^2}}\right)(2.5\cancel{\text{s}})$

$\vec{v}_i = +3.1 \frac{\text{m}}{\text{s}}$

The initial velocity of the ball was $3.1 \frac{\text{m}}{\text{s}}$, right.