Name: _____ Date: _____ Skill and Practice

2G Acceleration

Read:

Acceleration is the change in the speed or direction of an object over time—in other words, acceleration is a change in an object's velocity over time. To determine the rate of acceleration, you use the formula below. The unit for acceleration is meters per second per second (abbreviated m/s^2).

ACCELERATION

Acceleration (m/s^2) $a = \dfrac{v_f - v_i}{t}$

Change in velocity (m/s)

Time (s)

A positive value for acceleration shows speeding up, and negative value for acceleration shows slowing down. Slowing down is also called *deceleration*.

The acceleration formula can be rearranged to solve for other variables such as final speed (v_f) and time (t).

$$v_f = v_i + (a \times t)$$

$$t = \frac{v_f - v_i}{a}$$

Examples:

1. A skater increases her speed from 2.0 m/s to 10.0 m/s in 3.0 seconds. What is the skater's acceleration?

Looking for	**Solution**
Acceleration of the skater	$\text{Acceleration} = \dfrac{10.0 \text{ m/s} - 2.0 \text{ m/s}}{3.0 \text{ s}} = 2.7 \text{ m/s}^2$
Given Initial speed = 2.0 m/s Final speed = 10.0 m/s Change in time = 3.0 seconds	
Relationship $a = \dfrac{v_f - v_i}{t}$	The acceleration of the skater is 2.7 meters per second per second.

Skill and Practice

2. A car accelerates at a rate of 3.0 m/s^2. If its initial speed is 8.0 m/s, how many seconds will it take the car to reach a final speed of 25.0 m/s?

Looking for	**Solution**
The time to reach the final speed	Time $= \frac{25.0\ \text{m/s} - 8.0\ \text{m/s}}{3.0\ \text{m/s}^2} = 5.7\ \text{s}$
Given Initial speed = 8.0 m/s; Final speed = 25.0 m/s Acceleration = 3.0 m/s^2	The time for the car to reach its final speed is 5.7 seconds.
Relationship $t = \frac{v_f - v_i}{a}$	

Practice:

1. While traveling along a highway, a driver slows from 24 m/s to 15 m/s in 12 seconds. What is the automobile's acceleration? (Remember that a negative value indicates a slowing down or deceleration.)

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2. A parachute on a racing dragster heading north opens and changes the velocity of the car from 85 m/s to 45 m/s in a period of 4.5 seconds. What is the acceleration of the dragster?

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3. The table below contains data for a ball rolling down a hill. Fill in the missing data values in the table and determine the acceleration of the rolling ball.

Time (seconds)	Speed (km/h)
0 (start)	0 (start)
2	3
	6
	9
8	
10	15

4. A car traveling at a speed 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 decelerates at –4.0 m/s^2?

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5. If a car can go from 0 to 60. mph in 8.0 seconds, what would be its final speed after 5.0 seconds if its initial speed were 50. mph?

Skill and Practice

6. A cart rolling down an incline for 5.0 seconds has an acceleration of 4.0 m/s^2. If the cart has a initial speed of 2.0 m/s, what is its final speed?

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7. A helicopter's velocity increases from 25 m/s, east to 60 m/s, east in 5 seconds. What is the acceleration of this helicopter?

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8. As she climbs a hill, a cyclist slows down from 25 mph to 6 mph in 10 seconds. What is her deceleration?

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9. A motorcycle traveling at 25 m/s accelerates at a rate of 7.0 m/s^2 for 6.0 seconds. What is the final speed of the motorcycle?

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10. A car starting from rest accelerates at a rate of 8.0 m/s. What is its final speed at the end of 4.0 seconds?

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11. After traveling for 6.0 seconds, a runner reaches a speed of 10. m/s. What is the runner's acceleration?

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12. A cyclist accelerates at a rate of 7.0 m/s^2. How long will it take the cyclist to reach a speed of 18 m/s?

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13. A skateboarder traveling at 7.0 meters per second rolls to a stop at the top of a ramp in 3.0 seconds. What is the skateboarder's acceleration?

Challenge Problem:

14. Make up three acceleration problems of your own. Give the problems to a friend to solve and check their work.

    a. Make up a problem that involves solving for acceleration.

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    b. Make up a problem that involves solving for final speed (v_f).

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    c. Make up a problem that involves solving for time.
