

Chapter 1 Linear Motion

Example Problems

2.3 Projectile Motion

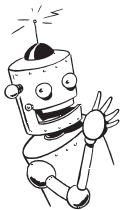
E1. A monkey is playing with a toy car on a table top. The monkey gives the car a push sending the car flying off the edge of a table with a horizontal velocity of 1.2 m/s. If the car lands 0.51 meters from the edge of the table, calculate the height of the table.

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
	$\Delta h =$	
	$t =$	

Draw a picture showing height, range, velocity, and the path of the projectile

Show your work

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a) _____ ← units

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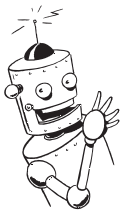
E2. A crazy monkey grabs your car keys and throws them off a cliff. If the initial velocity of the keys as they leave the monkey's hand is 3.50 m/s in the horizontal and the keys lands on the ground of 5.40 meters from the edge of the cliff, calculate the height of the cliff.

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
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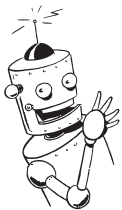
E3. Supplies are being dropped from a plane in order to help some people stranded on a deserted island. If the plane is flying at a altitude of 300 meters and has a horizontal speed of 60.0 m/s, calculate how far before the drop zone the supplies be released.

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	<i>Write the horizontal formula</i>
$v_x =$	$g =$	
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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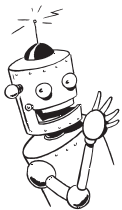
E4. Divers in Acapulco jump from a cliff that is 61 meters above the water. If the rocks below the cliff extend outward for 23 meters from the edge of the cliff, what is the minimum horizontal velocity a diver must have in order to clear the rocks below?

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	<i>Write the horizontal formula</i>
$v_x =$	$g =$	
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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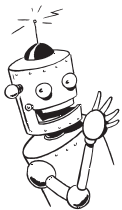
E5. In the movie *The Gods Must Be Crazy* a pilot drops an empty Coca-Cola bottle out of an airplane window. It is recovered by a native below who thinks it is a message from the gods. If the plane from which the bottle was dropped was flying at an altitude of 500 meters, and the bottle lands 400 meters horizontally from the initial dropping point, how fast was the plane flying when the bottle was released?

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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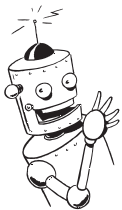
E6. Monkeys love playing darts. A monkey throws a dart horizontally with a speed of 12.4 m/s. The dart hits the dart board 0.32 meters below the height from which it was thrown. How far away is the monkey from the dart board?

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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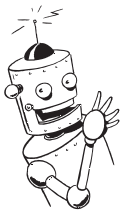
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E7. An object is thrown at an angle of 37° from a bridge 20 m above a river. The initial speed of the object is 30 m/s. Calculate the time of flight, the horizontal range, and the final velocity at impact.

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	<i>Write the horizontal formula</i>
$v_x =$	$g =$	
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
	$\Delta h =$	
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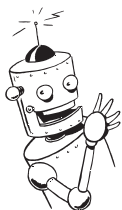
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E8. An archer tries to hit a shoulder-high target 15.0 metres away. The speed of the arrow as it leaves the bow is 30.0 m/s. Neglecting air friction, estimate the angle at which the archer should aim to compensate for the fall of the arrow due to the acceleration of gravity.

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	<i>Write the horizontal formula</i>
$v_x =$	$g =$	
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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Student Problems

2.3 Projectile Motion

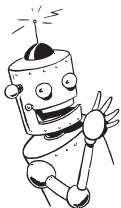
1. A monkey throws Justin Bieber off the balcony of his apartment. The monkey throws the “Biebs” with a horizontal velocity of 1.5 m/s, and the “Biebs” lands on the ground a horizontal distance of 8 meters from the edge of the balcony. Calculate how long the “Biebs” was in the air and the height of the balcony.

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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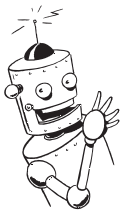
2. A rock is thrown horizontally at a speed of 24 m/s from the top of a cliff. If the rock hits the ground 3.5 seconds later, how far from the edge of the cliff did the rock land and approximately how high is the cliff?

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	<i>Write the horizontal formula</i>
$v_x =$	$g =$	
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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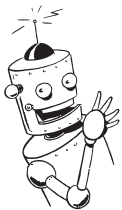
3. A baseball leaves the hand of a top professional pitcher traveling at 100 mph (44.7 m/s). The distance from the pitchers mound to the home plate is 18.29 meters. How much time does a batter have to react to the ball and how far vertically will the ball have dropped once it crosses home plate?

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
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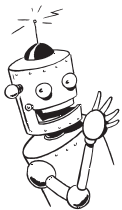
4. A gorilla designs a fancy Nerf gun that has a muzzle velocity of 250 m/s. In a Nerf gun war between a monkey and a gorilla, the gorilla fires a dart horizontally from a vertical height of 2 meter in the direction of the monkey but monkey ducks down just in time so that the dart goes flying past the monkey. Calculate how far the dart travel before striking the ground and how long the dart is in the air.

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
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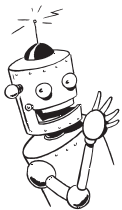
5. During world war II the B-17 bomber (The Flying Fortress) was instrumental to the victory achieved by the allied forces against Germany. If flying at a top speed of 287 mph (128.3 m/s) and at an altitude of 10,000 feet (3,000 m), how long would it take a bomb dropped from its cargo bay to hit the ground and at what distance before it's intended target would the bomber need to release it's load in order to hit the target?

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
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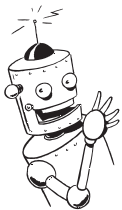
6. A rifle is aimed horizontally at a target located 30 meters away. The bullet hits the target but falls 0.0191 meters below the original horizontal aiming point. How long was the bullet in the air and what was the original muzzle velocity of the bullet?

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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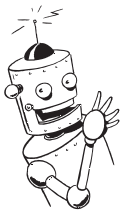
7. A police officer is chasing a monkey across a rooftop, both are running at 4.5 m/s. The monkey comes to the edge of the building and the only chance for escape is to jump to the next building. The next building is 4.8 m vertically below and 6.2 m away horizontally. If the monkey tries to make the jump, will he make it to the next building or will he fall short? (Hint: calculate how far horizontally the monkey travels then compare your calculated value to the actual distance between the buildings.)

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
$t =$	$v_{fy} =$	<i>Write the horizontal formula</i>
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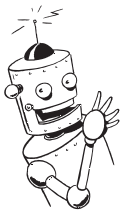
8. Monkeys love playing darts. A monkey claims that he can throw a dart and hit a 0.05 meters diameter bulls-eye on a dartboard located 2.0 meters away. The monkey starts his throw by lining up his dart even with the top edge of the bulls-eye. The dart leaves the monkey's hand traveling horizontal with a speed of 15 m/s. Calculate how far the dart falls bellow the top edge of the bulls-eye. Based on your calculation, does the dart land inside of the bulls-eye or bellow the bulls-eye?

<i>Horizontal (x)</i>	<i>Vertical (y)</i>	
$v_x =$	$g =$	<i>Write the horizontal formula</i>
$d_x =$	$v_{oy} =$	
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