

Chapter 4 Motion in Two Dimensions

Example Problems

4.1 Projectile Motion

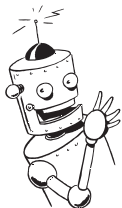
- Example 1:
 - While playing with a hot wheel car a monkey gives the car a big push sending the car flying off the edge of a table with a horizontal velocity of 1.2 m/s. If the car lands 0.51 m from the edge of the table, what is the height of the table?

<i>What are the givens and unknowns?</i>		<i>Write your formulas and show your work</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

- Example 2:
 - A crazy monkey throws your car keys off the edge of a cliff with a horizontal velocity of 3.50 m/s. If the keys lands on the ground a horizontal distance of 5.40 m from the edge of the cliff, what is the height of the cliff?

<i>What are the givens and unknowns?</i>		<i>Write your formulas and show your work</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

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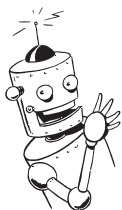


Chapter 4 Motion in Two Dimensions

- Example 3:
 - Supplies are dropped from a plane in order to help some people stranded on a desert island. If the plane is flying at an altitude of 300 m with a horizontal speed of 60.0 m/s, how far before the drop zone should the supplies be released?

<i>What are the givens and unknowns?</i>	<i>Write your formulas and show your work</i>
<i>Horizontal</i>	<i>Vertical</i>
$v_h =$	$g =$
$\Delta d_h =$	$v_{ov} =$
$t =$	$v_{fv} =$
	$\Delta h =$
	$t =$

Draw a sketch as seen from an observer on the ground



Chapter 4 Motion in Two Dimensions

- Example 4:
 - In the movie *The Gods Must Be Crazy* a pilot drops an empty Coca-Cola bottle out of an airplane. 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 m, and the bottle lands 400 m horizontally from the initial dropping point, how fast was the plane flying when the bottle was released?

What are the givens and unknowns?	Write your formulas and show your work
Horizontal	Vertical
$v_h =$	$g =$
$\Delta d_h =$	$v_{ov} =$
$t =$	$v_{fv} =$
	$\Delta h =$
	$t =$

Draw a sketch as seen from an observer on the ground



Chapter 4 Motion in Two Dimensions

• Example 5:

- Divers in Acapulco dive from a cliff that is 61 m high. If the rocks below the cliff extend outward for 23 m, what is the minimum horizontal velocity a diver must have in order to clear the rocks below?

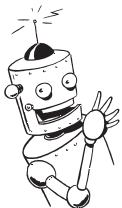
<i>What are the givens and unknowns?</i>		<i>Write the formula and show your work</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

• Example 6:

- 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 m below the height from which it was thrown. How far away is the monkey from the dart board?

<i>What are the givens and unknowns?</i>		<i>Write the formula and show your work</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

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Student Problems

4.1 Projectile Motion

YOU MUST SHOW ALL WORK! (Formulas, plug in numbers, answer boxed, units)

1. A monkey throws Justin Bieber off the balcony of his apartment. If the monkey throws the "The Biebs" with a horizontal velocity of 1.5 m/s, and "The Biebs" lands on the ground a horizontal distance of 8 m from the edge of the balcony. How long was the "The Biebs" in the air and what is the height of the balcony?

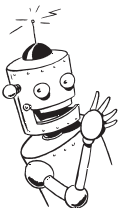
<i>What are the givens and unknowns?</i>		<i>Write the horizontal formula</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	<i>Write the vertical formula</i>
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

Draw a picture showing distance, height, and velocity.

Show your work:

a) _____ b) _____

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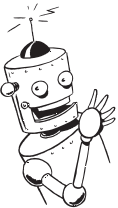
2. A baseball leaves the hand of a top professional pitcher traveling at 44.7 m/s (100 mph). The distance from the pitchers mound to the home plate is 18.29-m. How much time does a batter have to react to the ball and how far vertically will the ball have dropped once it crosses home plate?

<i>What are the givens and unknowns?</i>		<i>Write the horizontal formula</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	<i>Write the vertical formula</i>
$t =$	$v_{fv} =$	
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Draw a picture showing distance, height, and velocity.

Show your work:

a) _____ b) _____



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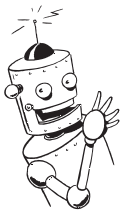
3. A rock is thrown horizontally at a speed of 24 m/s from the top of a cliff. If the rock hits the ground 3.5 seconds later, how far from the edge of the cliff did the rock land and approximately how high is the cliff?

<i>What are the givens and unknowns?</i>		
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	<i>Write the horizontal formula</i>
$\Delta d_h =$	$v_{ov} =$	
$t =$	$v_{fv} =$	<i>Write the vertical formula</i>
	$\Delta h =$	
	$t =$	

Draw a picture showing distance, height, and velocity.

Show your work:

a) _____ b) _____



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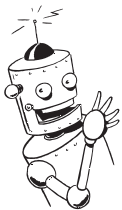
4. A gorilla designs a fancy nerf gun that has a muzzle velocity of 250 m/s. In a nerf gun war between a monkey and a gorilla a dart is fired horizontally from a 2 meter height by the gorilla towards the monkey but monkey ducks just in time and the dart goes flying past the monkey. How far will the dart travel before striking the ground and how long it the dart have been in the air?

<i>What are the givens and unknowns?</i>		<i>Write the horizontal formula</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	<i>Write the vertical formula</i>
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

Draw a picture showing distance, height, and velocity.

Show your work:

a) _____ b) _____



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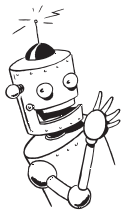
5. During world war II the B-17 bomber (The Flying Fortress) was instrumental to the victory achieved by the allied forces against Germany. If flying at a top speed of 128.3 m/s (287 mph) and at an altitude of 3,000-m (10,000 feet), how long would it take a bomb dropped from its cargo bay to hit the 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>What are the givens and unknowns?</i>		<i>Write the horizontal formula</i>
<i>Horizontal</i>	<i>Vertical</i>	
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$\Delta d_h =$	$v_{ov} =$	<i>Write the vertical formula</i>
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

Draw a picture showing distance, height, and velocity.

Show your work:

a) _____ b) _____



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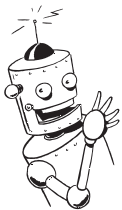
6. A rifle is aimed horizontally at a target located 30-m away. The bullet hits the target falling 0.0191-m below the original horizontal aiming point. How long was the bullet in the air and what was the original muzzle velocity of the bullet?

<i>What are the givens and unknowns?</i>		<i>Write the horizontal formula</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	<i>Write the vertical formula</i>
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

Draw a picture showing distance, height, and velocity.

Show your work:

a) _____ b) _____



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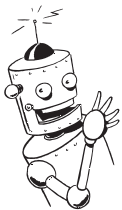
7. A police officer is chasing a monkey across a rooftop, both are running at 4.5 m/s. The monkey comes to the edge of the building and the only chance for escape is to jump to the next building. The next building is 4.8 m vertically below and 6.2 m away horizontally. If the monkey tries to make the 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>What are the givens and unknowns?</i>		<i>Write the horizontal formula</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	<i>Write the vertical formula</i>
$t =$	$v_{fv} =$	
	$\Delta h =$	
	$t =$	

Draw a picture showing distance, height, and velocity.

Show your work:

a) _____



Chapter 4 Motion in Two Dimensions

8. Monkeys love playing darts. A monkey claims that he can throw a dart and hit a 0.05-m 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 below the top edge of the bulls-eye. Does the dart land inside of the bulls-eye as the monkey claims or below the bulls-eye?

<i>What are the givens and unknowns?</i>		<i>Write the horizontal formula</i>
<i>Horizontal</i>	<i>Vertical</i>	
$v_h =$	$g =$	
$\Delta d_h =$	$v_{ov} =$	<i>Write the vertical formula</i>
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Draw a picture showing distance, height, and velocity.

Show your work:

a) _____ b) _____

