



# TEN PENNIES



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- CAMT Session
  - Houston
  - July 15 – 17, 2009
  - **Description:** Hands-on strategies will be discussed that enable students to comprehend the vocabulary and apply the concepts of slope and y-intercept. The requisite calculator skills will also be discussed.

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# TEN PENNIES ACTIVITY

Supplies :           one button  
(per student)   ten-twelve pennies  
                          one-half sheet of 1-inch "easel pad" paper

Procedure:   Students use a button to represent the origin, which enables them to move the origin to fit each problem. Pennies represent the points on the coordinate grid.

## Vocabulary/Concepts:

origin	function
quadrant	not a function
x-axis	direct variation
y-axis	constant function
horizontal	positive slope
vertical	negative slope
ordered pair	zero slope
abscissa	undefined slope
ordinate	graph with intercepts x-
coordinate	discrete/continuous
y-coordinate	parallel lines
domain	perpendicular lines
range	linear inequalities
linear	parent function (linear)
linear function	
slope	
y-intercept	
x-intercepts	
slope-intercept formula	
$y = mx + b$	
$y - y_1 = m(x - x_1)$	

## Linear Equation Discovery Lesson:

As students place their pennies, ASK THE FOLLOWING:

How do you move from penny to penny (slope)?  
 Place all other pennies that fit along the line.  
 How do you move from penny to penny to penny?  
 What is the VIP (Very Important Penny)  
 What is the x-intercept?

What is the equation that describes these pennies?  
 Put the equation in your calculator and check graph and table.

Place pennies at:

- |     |                       |                                      |
|-----|-----------------------|--------------------------------------|
| 1.  | (3,4) and (6,5)       | $y = (1/3)x + 3$                     |
| 2.  | (-2, -5) and (-4, -7) | $y = x - 3$                          |
| 3.  | (3, -5) and (-1, 3)   | $y = -2x + 1$                        |
| 4.  | (1, -4) and (-5, 4)   | $y = -(4/3)x + (\text{non-integer})$ |
| 5.  | (-4, -6) and (8, 3)   | $y = (3/4)x - 3$                     |
| 6.  | (-2, -4) and (2, 4)   | $y = 2x$                             |
| 7.  | (5, 7) and (-3, 7)    | $y = 7$                              |
| 8.  | (-2, -5) and (-2, 4)  | $x = -2$                             |
| 9.  | (6, -3) and (-6, 5)   | $y = (-2/3)x + 1$                    |
| 10. | (-5, -5) and (2, 2)   | $y = x$                              |

Note: slopes, y –intercepts, direct variation, parent function, x-intercepts, not a function

2.

### Parallel/Perpendicular Slopes Discovery Lesson:

Fill in the chart below as you work through the discovery lesson.

#	Linear Equation	Parallel Equation
1.		
2.		
3.		
4.		
5.		
6.		
7.		

Place five pennies along each line described below. A pencil placed on top of these pennies might help.

1.  $y = 2x - 3$

Place a sixth penny at (0, - 5)

Where would you place four more pennies to make two parallel lines?

What is the equation of this parallel line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

2.  $y = -\frac{1}{2}x + 5$

Place a sixth penny at (4, 0)

Where would you place four more pennies to make two parallel lines?

What is the equation of this parallel line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

3.  $y = (2/3)X + 1$

Place a sixth penny at (- 3, 1)

Where would you place four more pennies to make two parallel lines?

What is the equation of this parallel line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

4.  $y = - 3$

Place a sixth penny at (1, 2)

Where would you place four more pennies to make two parallel lines?

What is the equation of this parallel line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

5.  $y = - x - 2$

Place a sixth penny at (3, - 2)

Where would you place four more pennies to make two parallel lines?

What is the equation of this parallel line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

6.  $x = 4$

Place a sixth penny at  $(-1, -2)$

Where would you place four more pennies to make two parallel lines?

What is the equation of this parallel line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

7.  $y = (-3/2)x + 1$

Place a sixth penny at  $(2, 1)$

Where would you place four more pennies to make two parallel lines?

What is the equation of this parallel line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

Check For Understanding:

Write three equations that are parallel to  $y = (5/2)x - 6$ .

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Write three equations that are parallel to  $y = -3x + 1$ .

\_\_\_\_\_

**Parallel/Perpendicular Slopes** Discovery Lesson:

Fill in the chart below as you work through the discovery lesson.

#	Linear Equation	Perpendicular Equation
1.		
2.		
3.		
4.		
5.		
6.		
7.		

Place five pennies along: (a pencil placed on top of these pennies might help)

1.  $2x - y = 3$

Place pennies at  $(-2,4)$ ,  $(0, 3)$ ,  $(2,2)$ ,  $(4,1)$ ,  $(6,0)$

What is the equation of this perpendicular line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

2.  $2x + 3y = 6$

Place pennies at  $(-4,-6)$ ,  $(-2, -3)$ ,  $(0, 0)$ ,  $(2, 3)$ ,  $(4, 6)$

What is the equation of this perpendicular line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

6.

3.  $x + 2y = -4$

Place pennies at  $(-3, -3)$ ,  $(-2, -1)$ ,  $(-1, 1)$ ,  $(0, 3)$ ,  $(1, 5)$

What is the equation of this perpendicular line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

4.  $y = -3$

Place a sixth penny at  $(1, 2)$

Where would you place four more pennies to make the line perpendicular?

What is the equation of this perpendicular line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

5.  $x + y = -2$

Place pennies at  $(3, -2)$ ,  $(2, -3)$ ,  $(4, -1)$ ,  $(0, -5)$ ,  $(1, -4)$

What is the equation of this perpendicular line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

6.  $x = 4$

Place a sixth penny at  $(-1, -2)$

Where would you place four more pennies to make the line perpendicular?

What is the equation of this perpendicular line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

7.  $4x - y = -1$

Place pennies at  $(-8, 5)$ ,  $(-4, 4)$ ,  $(0, 3)$ ,  $(4, 2)$ ,  $(8, 1)$ .

What is the equation of this perpendicular line?

How do the slope and y-intercept compare to the slope and y-intercept in the original equation?

### Check For Understanding

Write one equation that is parallel and one equation that is perpendicular to these equations.

$5x - 2y = 12$

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 parallel

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 perpendicular

$3x + 8y = -32$

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 parallel

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 perpendicular

$y = -9$

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 parallel

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 perpendicular

## Linear Equations and Boundaries Discovery Lesson

1. Place pennies at  $(-3, 5)$ ,  $(1, 5)$ ,  $(1, -1)$  and  $(-3, -1)$

What are the equations and the boundaries that create this rectangle?

Equation	Boundary Description
$y = -1$	$-3 \leq x \leq 1$

2. Place pennies at  $(3, 2)$ ,  $(3, -4)$ ,  $(-6, 2)$  and  $(-6, -4)$

What are the equations and the boundaries that create this rectangle?

Equation	Boundary Description

3. Place pennies at  $(-5, 3)$ ,  $(-5, -1)$ ,  $(0, 3)$  and  $(4, -1)$

What are the equations and the boundaries that create this quadrilateral?

Equation	Boundary Description

4. Place pennies at  $(-2, -1)$ ,  $(2, -1)$ ,  $(4, -5)$  and  $(-4, -5)$

What are the equations and the boundaries that create this quadrilateral?

Equation	Boundary Description

5. Place pennies at  $(-2, -2)$ ,  $(1, 2)$ ,  $(-6, 2)$ .

What are the equations and the boundaries that create this triangle?

Equation	Boundary Description

6. Place pennies at  $(6, -6)$ ,  $(-8, -6)$ ,  $(0, 2)$ .

What are the equations and the boundaries that create this triangle?

Equation	Boundary Description

11.

Write three equations that are perpendicular to  $y = (5/2)X - 6$ .

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Write three equations that are perpendicular to  $y = -3X + 1$ .

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