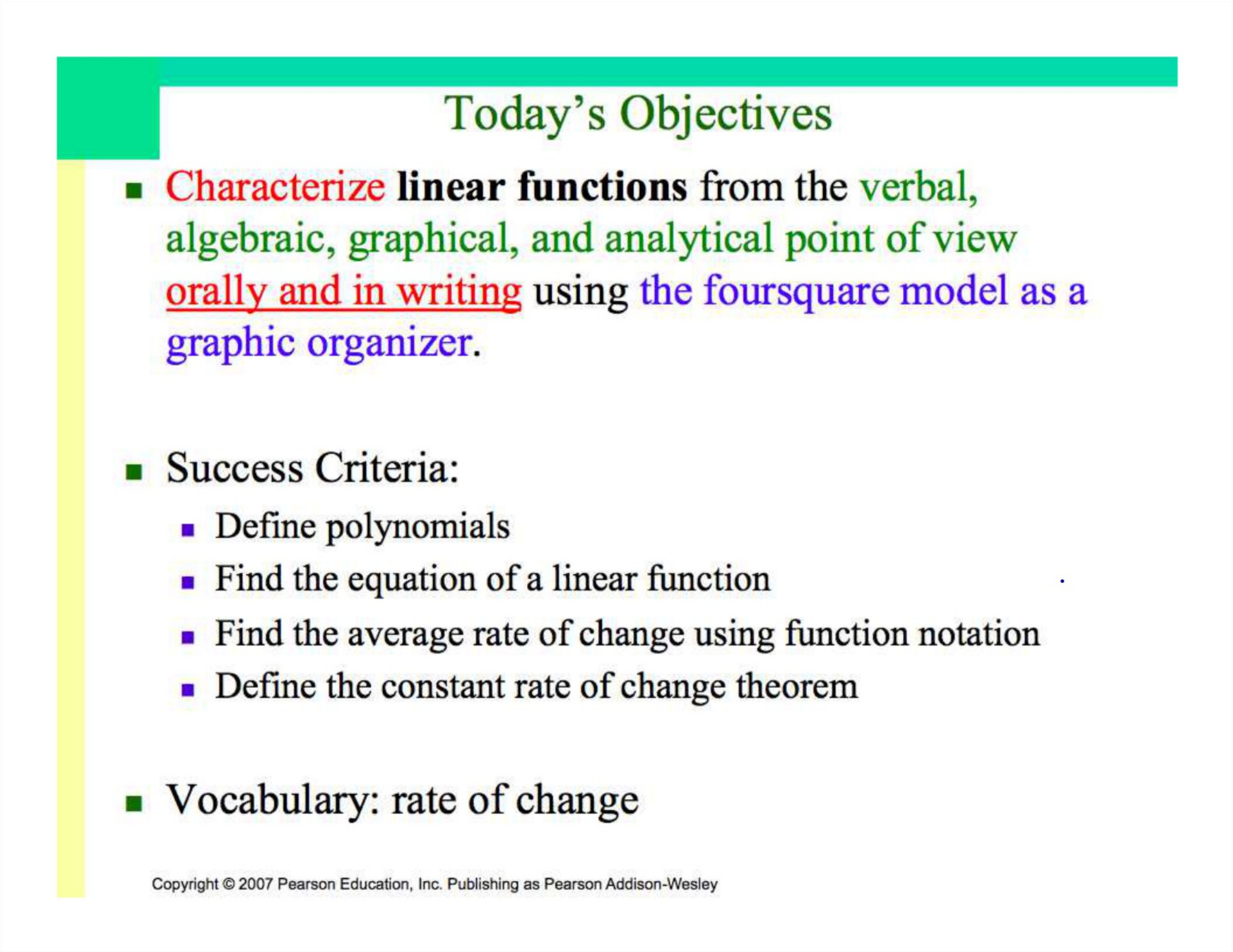


Today's Objectives

- Characterize **linear functions** from the verbal, algebraic, graphical, and analytical point of view orally and in writing using the foursquare model as a graphic organizer.

- Success Criteria:
  - Define polynomials
  - Find the equation of a linear function
  - Find the average rate of change using function notation
  - Define the constant rate of change theorem

- Vocabulary: rate of change

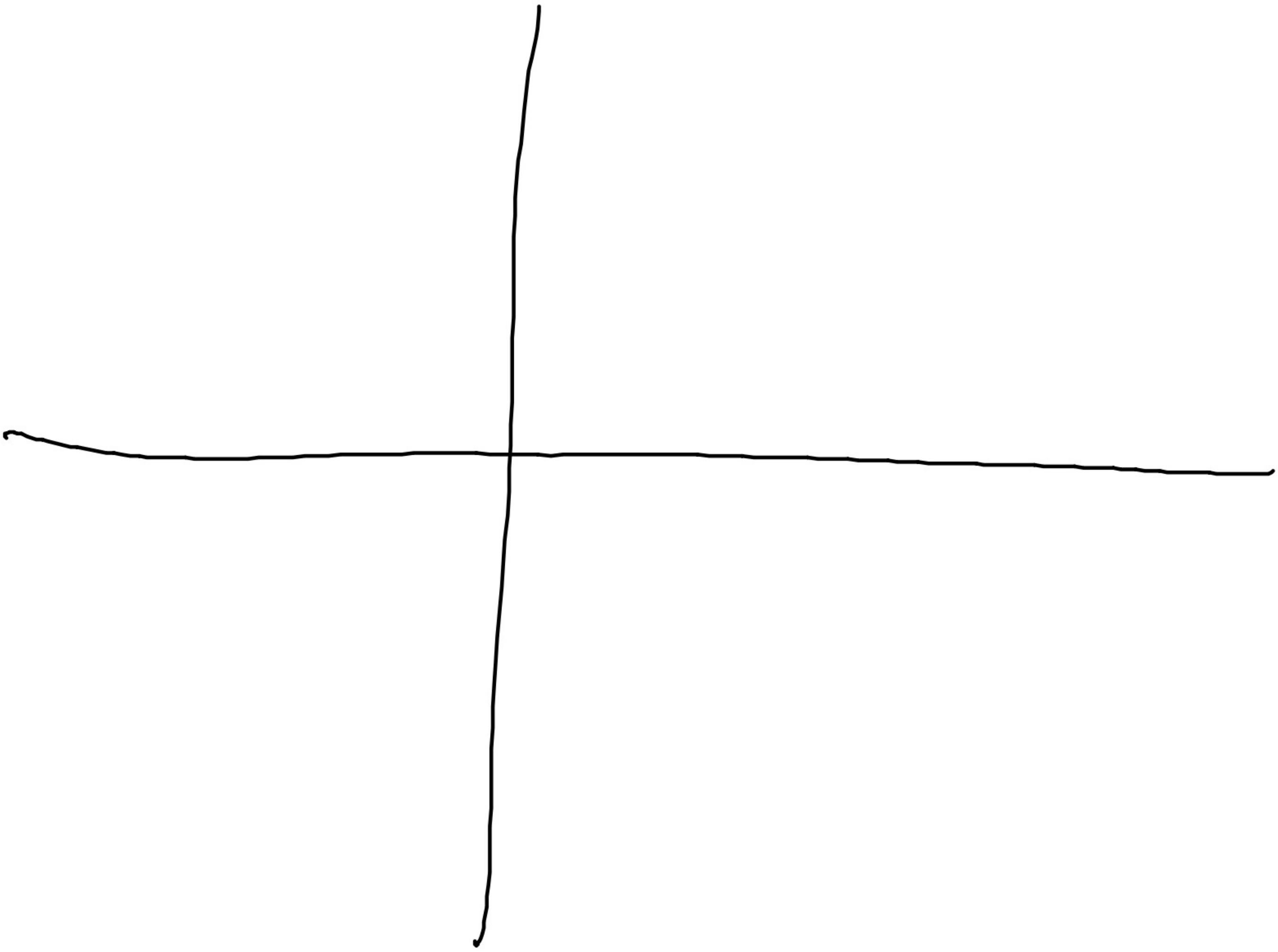
Polynomial Functions of No and Low Degree

Name	Form	Degree
Zero Function	$f(x)=0$	Undefined
Constant Function	$f(x)=a \ (a\neq 0)$ $f(x)=-\pi$	0
Linear Function	$f(x)=ax+b \ (a\neq 0)$	1
Quadratic Function	$f(x)=ax^2+bx+c \ (a\neq 0)$	2

Characterizing the Nature of a Linear Function

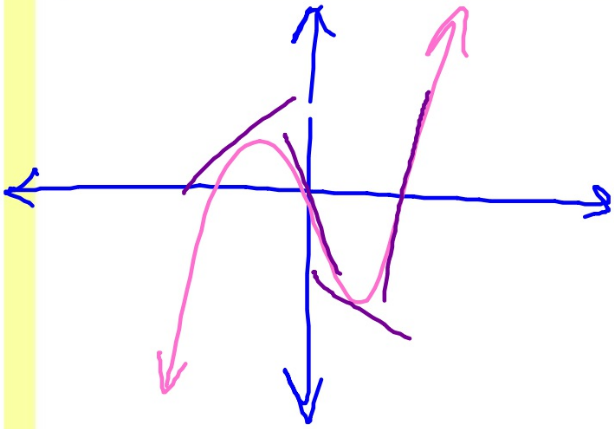
Fill in the following information in your 4-square graphic organizer.

Point of View	**Characterization**
Verbal	polynomial of degree 1
Algebraic	
Point Slope Form	$f(x)=m(x - x_1) + y_1, (m\neq 0)$
Slope Intercept Form	$f(x) = mx + b\ (m\neq 0)$ ← graphible
General Form /Standard	$Ax + By = C$
Graphical	slant line with slope m and y-intercept b
Analytical	function with constant nonzero rate of change m: f is increasing if $m>0$, decreasing if $m<0$; initial value of the function $= f(0) = b$



Average Rate of Change = slope

The average rate of change of a function $y = f(x)$ between $x = a$ and $x = b$, $a \neq b$, is $\boxed{\dfrac{f(b) - f(a)}{b - a}}$.



$$\frac{Y_1 - Y_2}{X_1 - X_2}$$ (x_1, y_1)

Constant Rate of Change Theorem

A function defined on all real numbers is a linear function if and only if it has a constant nonzero average rate of change between any two points on its graph.

Example **Finding an Equation of a Linear Function**

Write an equation for the linear function f such that $f(\overset{a}{-1}) = 2$ and $f(\overset{b}{2}) = 3$.

$$\frac{f(b)-f(a)}{b-a} = \frac{3-2}{2--1} = \frac{1}{3}$$

$$f(x)=m(x-x_1)+y_1$$

$$f(x)=\frac{1}{3}(x+1)+2$$

LO: The slope of the line is rise over run. From the given information we know that the line passes through the points (-1 , 2) and (2 , 3). Therefore the slope m = 1/3. There are three forms for a linear equation: point-slope, slope intercept, and general form. The point-slope form would be the best choice here because I have a point that is not the y-intercept and I can calculate the slope with the slope formula.

Example **Finding an Equation of a Linear Function**

Write an equation for the linear function f such that $f(-1) = 2$ and $f(2) = 3$.

The line contains the points (-1,2) and (2,3). Find the slope:

$$m = \frac{3-2}{2+1} = \frac{1}{3}$$

Use the point-slope formula and the point (2,3):

$$y - y_1 = m(x - x_1)$$

$$y - 3 = \frac{1}{3}(x - 2)$$

$$y - 3 = \frac{1}{3}x - \frac{2}{3}$$

$$y = \frac{1}{3}x + \frac{7}{3}$$

$$f(x) = \frac{1}{3}x + \frac{7}{3}$$

AM: Write eqns parallel/perp to lines through a point

1. Write the slope-intercept form of the equation of the line passing through the point $(-6, -3)$ and parallel to the line $y = 3x + 3$

[A] $y = -3x - 15$ [B] $y = -\frac{1}{3}x - 5$ [C] $y = 3x + 3$ [D] none of these

3 $(-6, -3)$

LO: The slope of the new line is ____ because parallel lines have ______________________. From the given information we know that the line passes through the point (,). There are three forms for a linear equation: _______________________, slope intercept, and _______________ form. The _____________________ form would be the best choice here because I have a ___________ and the __________. I will need to use algebra to rewrite the equation, because the answers are given in ____________________ form.

15

AM: Write eqns parallel/perp to lines through a point

2. Write the standard form of the equation of the line passing through the point (2, 2) and perpendicular to the line $-5x-y=-4$.

[✓ [A] $x-5y=-8$] [B] $-5x-y=8$ [C] $-5x+y=-8$ [D] none of these

G: $-5x-y=-4$

$+5x \quad +5x$

$\dfrac{-y}{-1}=\dfrac{5x-4}{-1}$

$y=-5x+4$

$m=-5 \quad \perp m=+\frac{1}{5}$

$(2,2)$

$y=\frac{1}{5}x+b$

$2=\frac{1}{5}(2)+b$

$2=\frac{2}{5}+b$

$-\frac{2}{5} \quad -\frac{2}{5}$

$\frac{8}{5}=b$

$y=\frac{1}{5}x+\frac{8}{5}$

15

$$5y=\left(\frac{1}{5}x+\frac{8}{5}\right)5$$

$$ax+by=c$$

$$5y=x+8$$

$$-x \qquad -x$$

$$-1(-x+5y)=(8)-1$$

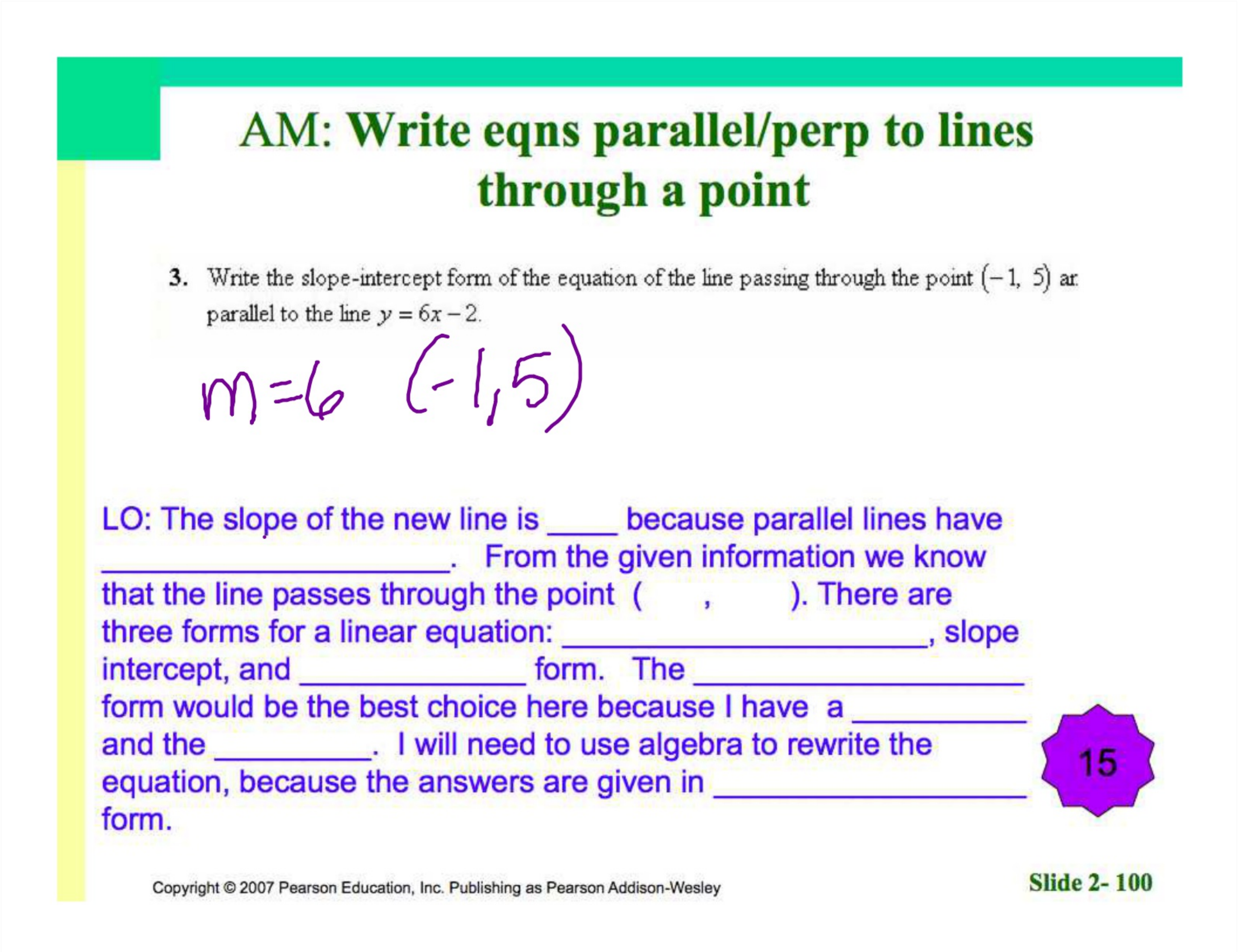
$$x-5y=-8$$

$$-\cancel{x}+\cancel{5y}=8$$

$$+\cancel{x}-\cancel{5y} \qquad +x-5y$$

$$-8 \qquad -8$$

$$-8=x-5y$$



AM: Write eqns parallel/perp to lines through a point

3. Write the slope-intercept form of the equation of the line passing through the point $(-1,\ 5)$ ar parallel to the line $y = 6x - 2$.

$m=6 \quad (-1,5)$

LO: The slope of the new line is ____ because parallel lines have ______________________. From the given information we know that the line passes through the point (,   ). There are three forms for a linear equation: _______________________, slope intercept, and ______________ form. The _____________________ form would be the best choice here because I have a ___________ and the __________. I will need to use algebra to rewrite the equation, because the answers are given in ____________________ form.

15

AM: Write eqns parallel/perp to lines through a point

4. Write the standard form of the equation of the line that passes through the point $(4, 1)$ and is perpendicular to the line $x - 3y = -6$.

LO: The slope of the new line is ____ because perpendicular lines have ____________________. From the given information we know that the new line passes through the point (,). There are three forms for a linear equation: ______________, __________________, and ______________ form. The _________________ form would be the best choice here because I have a ___________ and the _________. I will need to use algebra to rewrite the equation, because the answers are given in _________________ form.

15