Grasping GED® Higher Order Math Concepts for Deeper Understanding

Information, Resources, and Strategies for the Classroom

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Rules of Exponents

Name	Rule	Example
Product	$a^m \cdot a^n = a^{m+n}$	$x^3 \cdot x^4 = x^{3+4} = x^7$
Quotient	$a^m \div a^n = a^{m-n}$	$p^5 \div p^2 = p^{5-2} = p^3$
Power of a Power	$(a^m)^n = a^{mn}$	$(z^3)^2 = z^{3\cdot 2} = z^6$
Power of a Product	$(ab)^m = a^m b^m$	$(3y)^2 = 3^2 y^2 = 9y^2$
Power of a Quotient	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$\left(\frac{5}{3}\right)^2 = \frac{5^2}{3^2} = \frac{25}{9}$
Zero Exponent	$a^0 = 1$	$x^0 = 1;\ 6^0 = 1;\ 0^0 = 1$
Negative Exponent	$a^{-m} = \frac{1}{a^m}$	$b^{-3} = \frac{1}{b^3}; 5^{-2} = \frac{1}{5^2}$
Fractional Exponent	$a^{\frac{m}{n}} = \sqrt[n]{a^m}$	$4^{\frac{3}{2}} = \sqrt[2]{4^3} = \sqrt{64} = 8$

Square Root Tricks

Combining of Similar Radicals

$$a\sqrt{b} + a\sqrt{b} = (a + a)\sqrt{b}$$

$$a\sqrt{b} - c\sqrt{b} = (a - c)\sqrt{b}$$

Example 1: $2\sqrt{5} + 6\sqrt{5} = (2 + 6)\sqrt{5} \quad = 8\sqrt{5}$

Example 2: $3\sqrt{2} - 5\sqrt{2} = (3 - 5)\sqrt{2} \quad = -2\sqrt{2}$

Splitting Products

$$\sqrt{x^3} = \sqrt{x^2 \cdot x} = \sqrt{x^2}\sqrt{x} = x\sqrt{x}$$
$$\sqrt{20} = \sqrt{4 \cdot 5} = \sqrt{4} \cdot \sqrt{5} = 2\sqrt{5}$$

Splitting Quotients

$$\sqrt{\frac{x^2}{y^2}} = \frac{\sqrt{x^2}}{\sqrt{y^2}} = \frac{x}{y} \qquad \sqrt{\frac{4}{25}} = \frac{\sqrt{4}}{\sqrt{25}} = \frac{2}{5}$$

Square and Square Root Exercise

Simplify $2\sqrt{2}\left(2\sqrt{3} + 3\sqrt{3}\right)$

Simplify $3\sqrt{24x^3}$

Simplify $\left(-4\sqrt{2}\right)^2$

Simplify $\sqrt{\frac{12x^2}{4}}$

Cube and Cube Root Exercise

Simplify $2\sqrt{2}\left(2\sqrt{3}+3\sqrt{3}\right)$

Simplify $3\sqrt{24x^3}$

Simplify $\left(-4\sqrt{2}\right)^2$

Simplify $\sqrt{\frac{12x^2}{4}}$

Cube and Cube Root Tricks

Combining of Similar Radicals

$$a\sqrt[3]{b}+a\sqrt[3]{b}=(a+a)\sqrt[3]{b}$$

$$a\sqrt[3]{b}-c\sqrt[3]{b}=(a-c)\sqrt[3]{b}$$

Example 1: $2\sqrt[3]{5}+6\sqrt[3]{5}=(2+6)\sqrt[3]{5}\ =8\sqrt[3]{5}$

Example 2: $3\sqrt[3]{2}-5\sqrt[3]{2}=(3-5)\sqrt[3]{2}\ =-2\sqrt[3]{2}$

Splitting Products

$$\sqrt[3]{x^4}=\sqrt[3]{x^3\cdot x}=\sqrt[3]{x^3}\cdot\sqrt[3]{x}=x\sqrt[3]{x}$$

$$\sqrt[3]{16}=\sqrt[3]{8\cdot 2}\ =\sqrt[3]{8}\cdot\sqrt[3]{2}\ =2\sqrt[3]{2}$$

Splitting Quotients

$$\sqrt[3]{\frac{x^3}{y^3}}=\frac{\sqrt[3]{x^3}}{\sqrt[3]{y^3}}=\frac{x}{y}$$

$$\sqrt[3]{\frac{27}{125}}=\frac{\sqrt[3]{27}}{\sqrt[3]{125}}=\frac{3}{5}$$

Undefined Value Over the Set of Real Numbers

There are two types of expressions that are undefined over the set of real numbers:

- Fractions with zero in the denominator (or an expression equivalent to zero)

Examples: $\frac{-3}{0}$; $\frac{0}{0}$; $\frac{x-3}{x+3}$, where $x = -3$

- Square roots of negative numbers (or expressions which, when simplified, result in negative numbers).

Examples: $\sqrt{-1}$; $x^2 + 1 = 0$; $\sqrt{-3x^2}$; $\sqrt{x^3 - 2}$, where $x = -1$

Imaginary Numbers

Try squaring numbers to see fi we can get a negative result.

$1^2 = 1$ $0^2 = 0$ $(-2)^2 = 4$ $(0.2)^2$

"**Imagine**" there is such a number. Let's call this number ***i*** for imaginary. Then we can do this…

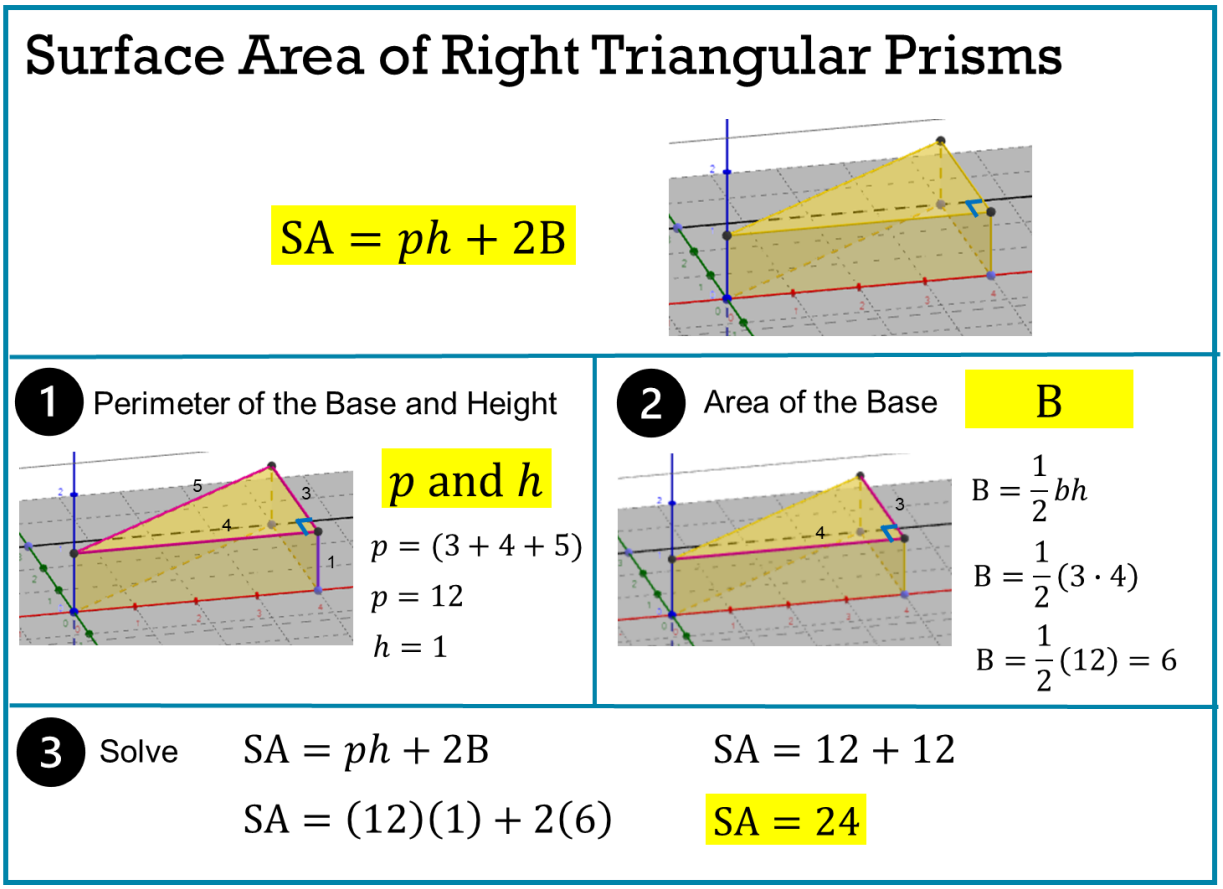
$$\boldsymbol{i^2 = i \cdot i = -1}$$

"**Imagine**" there is such a number, called ***i*** for imaginary. Then we can also do this…

$$\boldsymbol{\sqrt{i^2} = \sqrt{i \cdot i} = \sqrt{-1}}$$

$$\boldsymbol{i = \sqrt{-1}}$$

Anchor Chart: Surface Area of Right Triangular Prisms

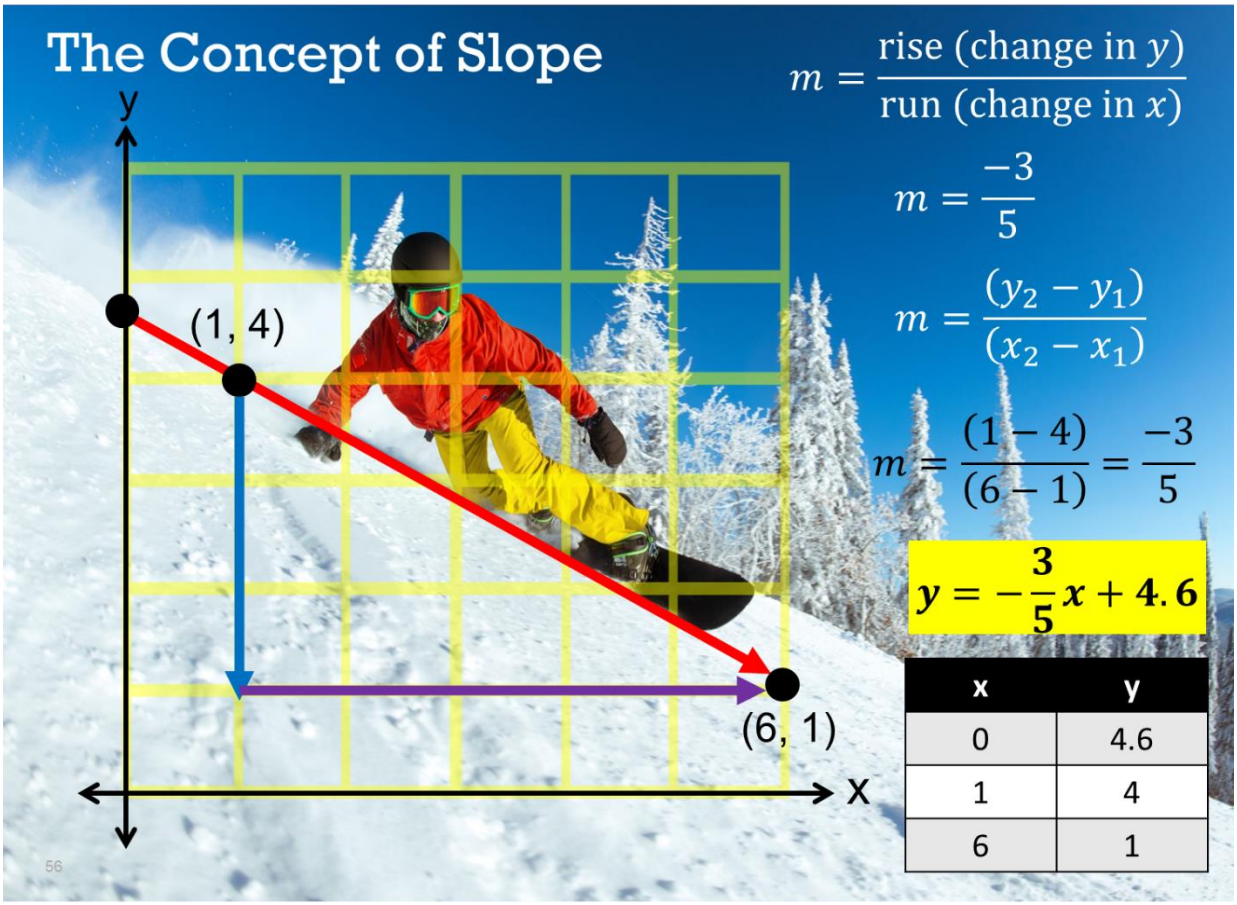


Real World Problems with Inequalities

Instructions: Solve the problem.

Annie is planning a business meeting for her company. She has a budget of $1,325 for renting a meeting room at a local hotel and providing lunch. She expects 26 people to attend the meeting. The cost of renting the meeting room is $270. Write an inequality to show how to find the amount, x, Annie can spend on lunch for each person?

The Concept of Slope



Forms of Linear Equation

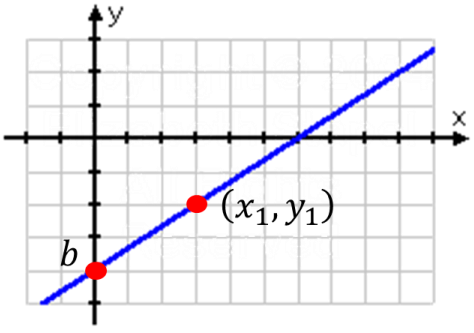
Forms of Linear Equations	Equations
Slope-Intercept Form	$y = mx + b$
Point-Slope Form	$y - y_1 = m(x - x_1)$
Standard Form	$cx + dy = e$

m = slope

b = y−intercept

(x_1, y_1) = a point on the line

c, d and e are constants



Anchor Chart: Finding Slope

T-Chart

Use the slope formula.

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

Example:

x	y
1	-9
3	-6
5	-3

$$m = \frac{-3 - (-9)}{5 - 1}$$

$$m = \frac{6}{4} = \frac{3}{2}$$

Slope-Intercept

Locate *m* in the equation.

$$y = mx + b$$

Example:

$$y = 3x - 4$$

$$y = mx + b$$

$$m = 3$$

Standard

$$cx + dy = e$$

Transform equation to slope-intercept form and locate *m* in the equation.

Example:

$$3x + 9y = 4$$

$$-3x \qquad -3x$$

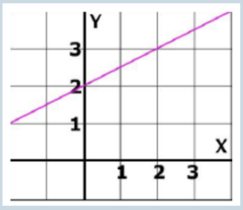
$$9y = -3x + 4$$

$$\frac{9y}{9} = \frac{-3x}{9} + \frac{4}{9}$$

$$y = \frac{-3}{9}x + \frac{4}{9}$$

$$m = \frac{-3}{9}$$

Graph



Locate two points on the graph, then use the slope formula.

Example:

$$(0.2) \text{ and } (2,3)$$

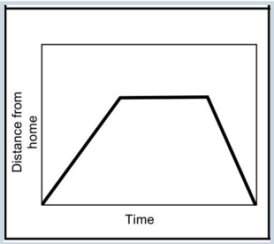
$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

$$m = \frac{3 - 2}{2 - 0}$$

$$m = \frac{1}{2}$$

Anchor Chart: Interpreting Slopes in Distance-Time Graphs

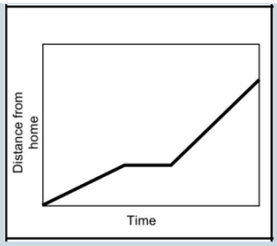
Scenario 1



Example:
Maria walked to the store at the end of her street, bought a gallon on milk and then ran all the way back.

Time	Distance
0	0
1	20
2	40
3	40
4	40
5	0

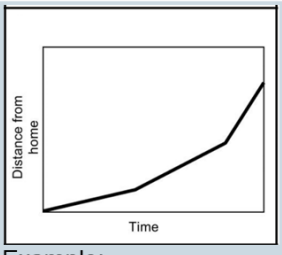
Scenario 2



Example:
Lucy walked slowly along the road, stopped to look at her cell phone, realized that she was late, and then started running.

Time	Distance
0	0
1	20
2	40
3	40
4	80
5	120

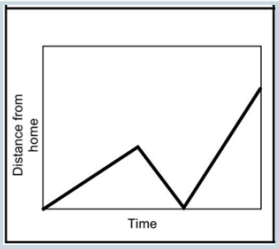
Scenario 3



Example:
Opposite Tom's home is a hill. He climbed slowly up the hill, walked across the top, and then ran quickly down the other side.

Time	Distance
0	0
1	10
2	20
3	40
4	60
5	120

Scenario



Example:
Mario went out to walk with some friends. Upon realizing he left his wallet, ran back home to get it. He then had to run to catch up with the others.

Time	Distance
0	0
1	30
2	60
3	0
4	60
5	120

Resources from the World Wide Web

Build Your Own Right Triangular Prism (GeoGebra) https://www.geogebra.org/m/j6xVky5C

Build Your Own Rectangular Pyramid (GeoGebra) https://www.geogebra.org/m/r5RXbuby

Build Your Own Sphere (GeoGebra) https://www.geogebra.org/m/UPqkkdzZ

Florida IPDAE. Lesson plans for both ABE and GED®-level mathematics developed by Florida adult educators. www.floridaipdae.org

Fractions | Adding and Subtracting Fractions | Dividing and Multiplying Fractions by MathTricks https://www.facebook.com/reel/657776426087451/

GED Calculator-Prohibited Indicators
https://ged.com/wp-content/uploads/Math-Skills-Calculator-Prohibited-2.pdf

GED Calculator Reference Guide
https://ged.com/wp-content/uploads/calculator_reference_guide.pdf

GED Mathematics Formula Sheet and Explanations
https://ged.com/wp-content/uploads/math_formula_sheet-1.pdf

GED Teaching Resources https://ged.com/educators_admins/teaching/teaching_resources/

GeoGebra App Download Page https://www.geogebra.org/download

Graphing Riddle http://exponentialcurve.blogspot.com/2010/04/some-funish-worksheets.html

Slope-Intercept Form Battleship http://iisanumber.blogspot.com/2013/02/slope-intercept-form-battleship.html

The Math Learning Center Number Line App
https://apps.mathlearningcenter.org/number-line/

Why Can't You Divide by Zero (Video) https://www.youtube.com/watch?v=NKmGVE85GUU