Sample Student Workbook

Intermediate Algebra: Puzzles for Practice

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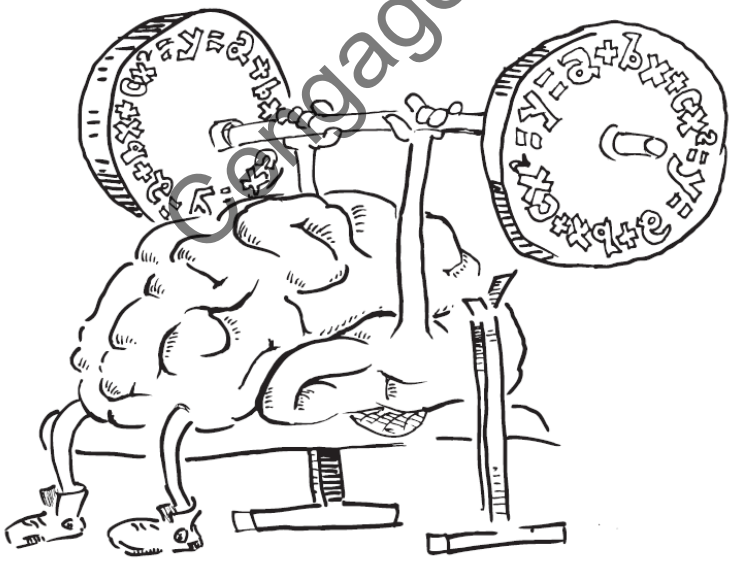

Algebra is weightlifting for the Brain!

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Student Activity

Match Up on Fractions

Match-up: Match each of the expressions in the squares of the table below with its simplified value at the top. If the solution is not found among the choices A through D, then choose E (none of these).

A 1 **B** $\frac{3}{4}$ **C** $\frac{7}{8}$ **D** 0 **E** None of these

$\left(\frac{3}{2}\right)\left(\frac{1}{2}\right)$	$\frac{7}{6}\div\frac{4}{3}$	$\frac{7}{8}\div 0$	$2\frac{1}{8}-\frac{5}{4}$
$\frac{15}{8}-1$	$6\left(\frac{1}{6}\right)$	$\frac{2}{3}\div\frac{8}{9}$	$0\div\frac{3}{4}$
$\frac{1}{2}+\frac{3}{8}$	$\frac{19}{12}-\frac{5}{6}$		
$\frac{1}{5}+\frac{8}{10}$	$\frac{3}{4}(0)$		
$\frac{1}{2}+\frac{2}{2}$	$\frac{1}{3}\div\frac{1}{3}$		

I thought we shared a common denominator, but he was only a fraction of the person I thought he was.

Student Activity

Signed Numbers Magic Puzzles

Directions: In these "magic" puzzles, each row and column adds to be the same "magic" number. Fill in the missing squares in each puzzle so that the rows and columns each add up to be the given magic number.

Magic Puzzle #1

–2	8	
	–9	4

Magic Number = 5

Magic Puzzle #2

		4
–5		
8		–6

Magic Number = 0

Magic Puzzle #3

		$2\frac{1}{4}$
	$2\frac{1}{2}$	$-2\frac{1}{2}$
$\frac{1}{4}$		

Magic Number = $\frac{1}{2}$

Magic Puzzle #4

–2		9	–7
	–9		4
8	–4		–5
		–6	

Magic Number = 1

Magic Puzzle #5

–8	–3		7
	–11	2	6
8	–2		–7

Magic Number = –2

Student Activity

Follow the Multiplication Road

Match-up: Find your way from start to finish along the multiplication road by shading in matching pairs of algebraic expressions. The first pair has been shaded for you!

START					
$3(4a)$	$7a$	$\frac{4}{3}(4x)$	$\frac{x}{3}$	$\frac{4x}{3}(4)$	$\frac{z}{5}$
$12a$	$\frac{2}{3}(3x)$	$2x$	$-x(-9)$	$-9x$	$5\left(\frac{2z}{5}\right)$
$\frac{1}{12}(2a)$	$6x$	$\frac{4x^2}{5x^2}$	$9x$	$9-x$	$5\left(\frac{5z}{2}\right)$
$(0.8x)(-2)$	$1.6x$	$\frac{4x^2}{5}$	$\frac{4}{5}(x^2)$	$8x$	$5z$
$(5t)(-4)$	$12a$	$-3(-4a)$	$-7a$	$4(4x)$	$4x^2$
$-20t$	$(-5t)(-4)$	$-9t$	$\frac{2}{3}(12t^2)$	$9t^2$	$\frac{x^2}{7x^2}$
$5(-2x)$	$-10x$	$\frac{3}{4}(8t^2)$	$6t^2$	$\frac{1}{7}(x^2)$	$\frac{x^2}{7}$
					FINISH

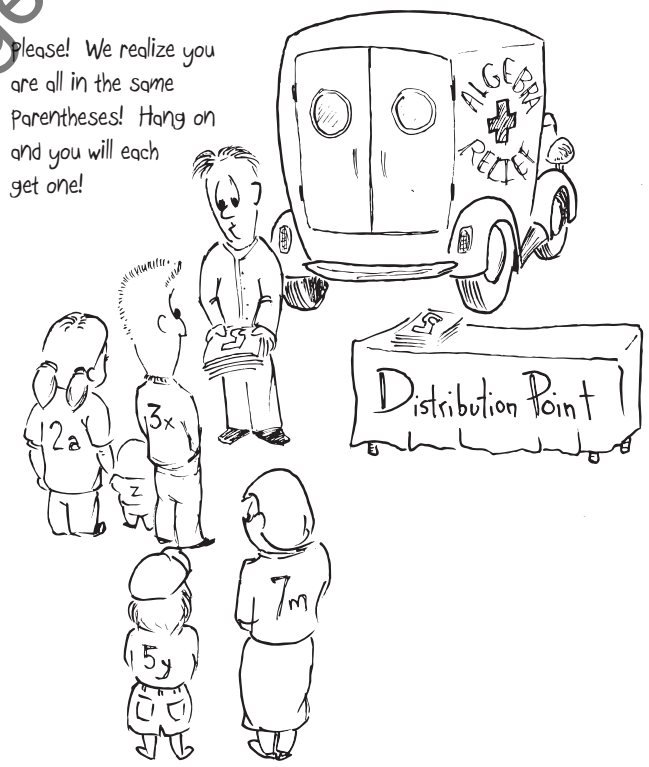
Student Activity

Match Up on Like Terms and Distribution

Match-up: Match each of the expressions in the squares of the lower table with an equivalent expression from the top. If the solution is not found among the choices A through D, then choose E (none of these).

A $4x+16-12y$ **B** $5+4x+6y$ **C** $x+y-z$ **D** $3x+3y+3z$ **E** None of these

$3(x+y)+z$	$5+2x+6y+2x$	$3y+3(x+z)$	$2(8+2x-6y)$
$(x-z)+y$	$4(x-3y+4)$	$4(x+3y)+16$	$6y+5+4x$
$4(x+4)-12y$	$2(2x+8-6y)$	$(5+6y)+4x$	$\frac{1}{3}(-3z+3y+3x)$
$5+2(3y+2x)$	$2y-(z+y)+x$	$4x+12y-16$	$(4x+16)-12y$
$2(2x+8)+6y$	$3x+3(z+y)$		
$5x+3y+3z-2x$	$6y+5+4x$		
$6x+6y-3(x+y-z)$	$x-(z-y)$		
$(z+y)-z$	$4x-(12y-16)$		



Student Activity
Stepping Stones

Directions: Shade pairs of equivalent expressions to create a path of stepping stones from Start to Finish.

Start $10\left(\frac{1}{2}\right)$	5	$8\left(\frac{3x}{2}\right)$	$12x$	$6\left(-\frac{z}{3}\right)$	$3z$
$8x$	$15x$	$-12x$	$-3z$	$-2z$	$2z$
$4\left(\frac{3x}{2}\right)$	$-15x$	$24x\left(-\frac{5}{8}\right)$	12	$9\left(\frac{4}{3}\right)$	36
$6x$	$\frac{3}{2}\left(\frac{1}{x}\right)$	$-4u$	$3\left(\frac{1}{4}\right)$	$\frac{1}{12}$	$x\left(-\frac{1}{7}\right)$
$5\left(\frac{3x}{10}\right)$	$\frac{3x}{2}$	$-6u\left(-\frac{2}{3}\right)$	$4u$	$4\left(\frac{2}{u}\right)$	$\frac{x}{7}$
$\frac{x}{2}$	$-9u$	$9u$	$\frac{2x}{3}\left(\frac{3}{2}\right)$	x	**Finish**

Student Activity

Tic-Tac-Toe with Inequalities

Tic-tac-toe #1: If the inequality in the square is true, then put an **O** on the square. If it is false, then put an **X** on the square.

$-5 < -1$	$8 > 8$	$-6 > -2$
$2 - 3 < -1$	$\frac{1}{2} < \frac{1}{3}$	$7 \le 7$
$a \ge a$	$0 < -4$	$\lvert -3 \rvert > 1$

Tic-tac-toe #2: If the number in the square is a solution to the inequality, then put an **O** on the square. If it is false, then put an **X** on the square.

$x - 2 < 7$ 9	$x + 4 \ge -2$ -7	$x - 3 \le -1$ 1
$-2x < 4$ -1	$\frac{1}{2}x \ge 2$ 6	$-1 \le 2 - x$ 3
$8 > 4 - x$ -5	$-x < 4$ -3	$2x + 3 < 3x$ 2

Student Activity
Matching Up the Different Cases

Directions: Begin by isolating the absolute value in each of the equations and inequalities below. Then categorize the problem as one of the four cases or a special case. The first one has been done for you.

Let k be a **positive** constant and let X, X_1, and X_2 be mathematical expressions.

Case 1:	Case 2:	Case 3:	Case 4:	Special Case:
$\lvert X \rvert = k$	$\lvert X_1 \rvert = \lvert X_2 \rvert$	$\lvert X \rvert < k$ $\lvert X \rvert \le k$	$\lvert X \rvert > k$ $\lvert X \rvert \ge k$	If the constant is negative or zero.

$2\lvert x-3 \rvert < 4$ $\lvert x-3 \rvert < 2$ **CASE 3**	$\lvert x-3 \rvert - 4 \ge 2$	$\lvert 2a-3 \rvert + 5 > 3$	$\frac{\lvert x \rvert}{3} - 2 = 4$
$\lvert x+4 \rvert = \lvert 2x-2 \rvert$	$1 = \lvert 2t-4 \rvert + 4$	$5 - \lvert 2x \rvert < 2$	$4\lvert x+3 \rvert - 3 \le 2$
$-2\lvert 4y \rvert < 10$	$\frac{\lvert 3x-4 \rvert}{-6} \le -2$	$1 > \lvert 3-b \rvert - 6$	$\lvert 2x \rvert = \lvert x+3 \rvert$
$5 - \lvert x+4 \rvert = 2$	$6 - 2\lvert x+4 \rvert \le 0$	$\lvert x-4 \rvert + 5 = 5$	$3 < \frac{\lvert d+12 \rvert}{5}$

Student Activity

Match Up on Slopes

Match-up: In each box of the grid below, you will find either a pair of points that is on a line or the description of a line in words. Match each line that is described with its slope in the choices A through E. If the slope is not found in A through E, then choose F (none of these).

A 2 **B** $\frac{1}{2}$ **C** -1 **D** 0 **E** undefined **F** None of these

$(0,0)$ and $(3,0)$	$(4,4)$ and $(-4,0)$	$\left(\frac{3}{2},\frac{1}{2}\right)$ and $\left(\frac{3}{2},\frac{10}{2}\right)$	$(-3,-6)$ and $(3,-4)$
$(2,5)$ and $(3,4)$	$\left(\frac{7}{6},\frac{1}{9}\right)$ and $\left(\frac{1}{6},\frac{10}{9}\right)$	$(3.14, 2.72)$ and $(1.14, 1.72)$	$(-6,-1)$ and $(-8,0)$
$(-100,300)$ and $(-100,50)$	$(9,7)$ and $(7,9)$	$(1,1)$ and $(-5,1)$	$(8,8)$ and $(7,6)$
The line is a vertical line.	The line goes to the right 1 unit for every 2 units it goes up.	The line is a horizontal line.	The line goes down 1 unit for every 1 unit it goes to the right.

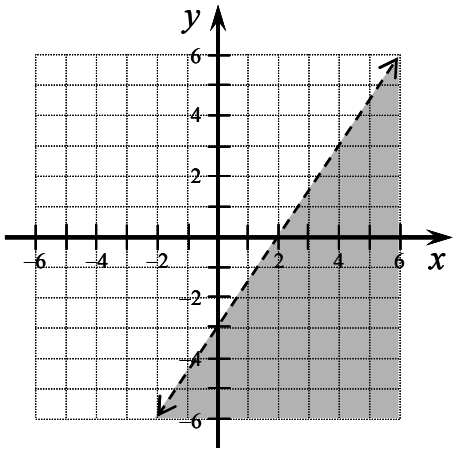
Student Activity

Tic-Tac-Toe on Inequality Solutions

Directions for Game #1: If the ordered pair in the square **IS** a solution of the inequality, then circle the ordered pair (thus putting an **O** on the square). If it **IS NOT** a solution, then put an **X** over the ordered pair in the square.

$x+y<5$ $(2,3)$	$y<x+6$ $(9,3)$	$y>0$ $(2,-1)$
$2x-3y\le 0$ $\left(\frac{1}{2},\frac{1}{3}\right)$	$x>y+4$ $(4,0)$	$x\le 5$ $(4,9)$
$3x+3\ge 4y+4$ $(2,1)$	$3-x<-4$ $(8,1)$	$y-2x\le 3x-y$ $(1,5)$

Directions for Game #2: If the ordered pair in the square **IS** a solution of the graphed inequality, then circle the ordered pair (thus putting an **O** on the square). If it **IS NOT** a solution, then put an **X** over the ordered pair in the square.



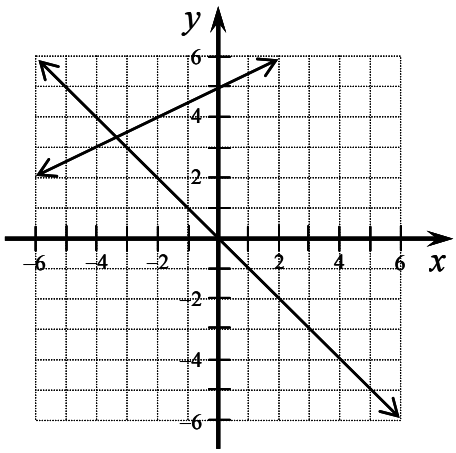
$(4,1)$	$(4,3)$	$(-2,-4)$
$(1,-3)$	$(-0.5,-6)$	$(0,0)$
$(-1,-4)$	$(-3,-6)$	$(7,-7)$

Student Activity

Following the Clues Back to the System of Equations

Directions: In each "crime-scene" below, you are shown the graph of a system of equations. Use your mathematical powers of reasoning (and detective skills) to determine what the system of equations must have been to result in this graph.

1.



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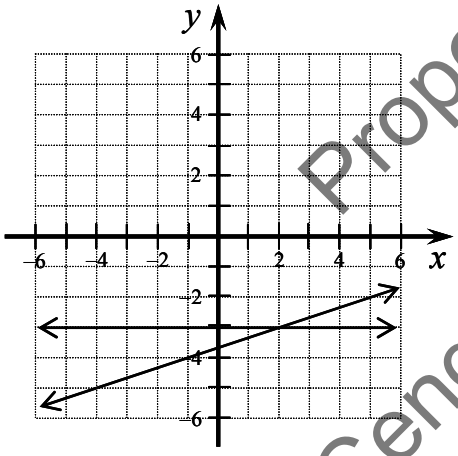

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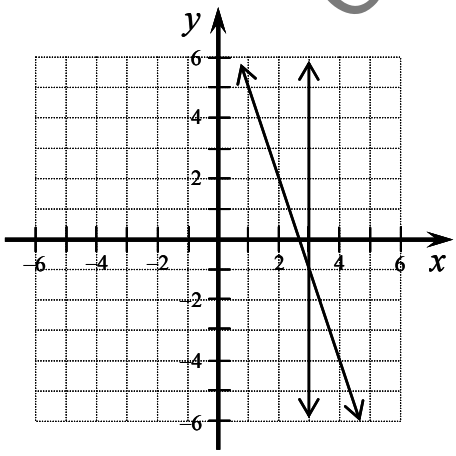


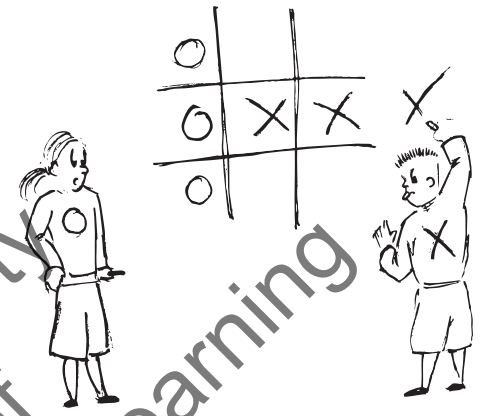
Student Activity

Tic-tac-toe on Inequalities

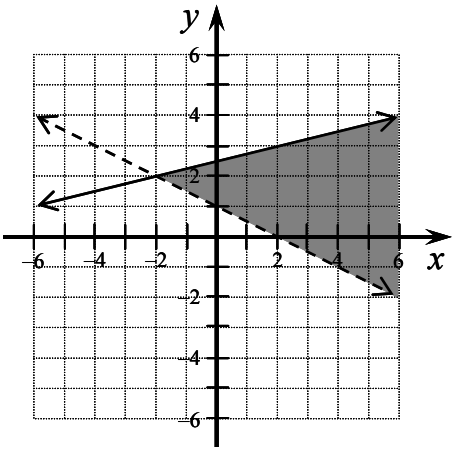
Directions for Tic-tac-toe #1: If the ordered pair in the square **IS** a solution of the system of inequalities shown below, then circle the ordered pair (thus putting an **O** on the square). If it **IS NOT** a solution, then put an **X** over the ordered pair.

System of Inequalities: $\begin{cases} y < 4x + 2 \\ 3x - 3y \geq 6 \end{cases}$

$(-2,-6)$	$(1,1)$	$(4,1)$
$(6,2)$	$(8,6)$	$(4,4)$
$(2,0)$	$(0,2)$	$(0,-2)$



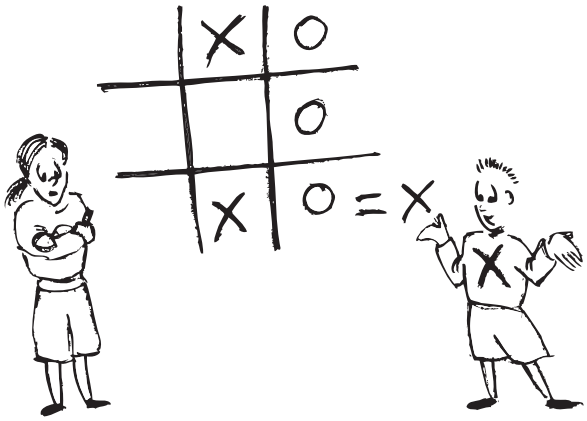
Directions for Tic-tac-toe #2: If the ordered pair in the square **IS** a solution of the graphed system of inequalities, then circle the ordered pair (thus putting an **O** on the square). If it **IS NOT** a solution, then put an **X** over the ordered pair.



$(-2,2)$	$(2,0)$	$(2,3)$
$(8,3)$	$(3,4)$	$(0,4)$
$(6,4)$	$(6,-2)$	$(4,0)$

Student Activity

Tic-Tac-Toe on Row Echelon Form



A matrix is in **row echelon form** if it has 1's down its main diagonal and a zero below its main diagonal.

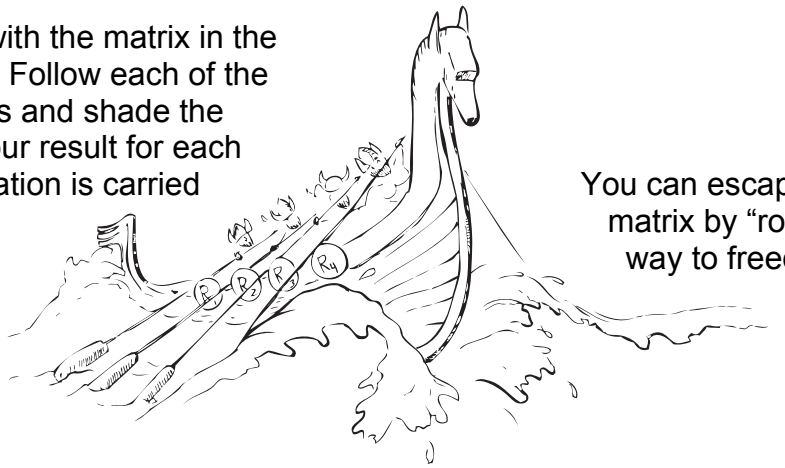
Directions: If the matrix in the square is in row echelon form, then circle it (put an **O** on the square). If the matrix is **not** in row echelon form, then mark it with an **X**.

$\left[\begin{array}{cc\|c} 1 & 3 & 4 \\ 0 & 2 & 6 \end{array}\right]$	$\left[\begin{array}{cc\|c} 1 & 3 & 5 \\ 0 & 1 & 4 \end{array}\right]$	$\left[\begin{array}{ccc\|c} 1 & 2 & 5 & -7 \\ 0 & 1 & 2 & 15 \\ 0 & 0 & 1 & \frac{1}{2} \end{array}\right]$
$\left[\begin{array}{ccc\|c} 1 & 0 & 5 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 6 \end{array}\right]$	$\left[\begin{array}{ccc\|c} 1 & 0 & 4 & 5 \\ 0 & -1 & 2 & 6 \\ 0 & 0 & 1 & 0 \end{array}\right]$	$\left[\begin{array}{ccc\|c} 1 & 0 & 4 & 5 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 1 & 0 \end{array}\right]$
$\left[\begin{array}{cc\|c} 1 & 0 & \frac{3}{4} \\ 0 & 1 & \frac{1}{2} \end{array}\right]$	$\left[\begin{array}{cc\|c} 1 & 2 & 3 \\ 1 & 0 & 4 \end{array}\right]$	$\left[\begin{array}{cc\|c} 4 & 1 & 2 \\ 1 & 0 & -3 \end{array}\right]$

Student Activity

Rowing to Freedom

Directions: Begin with the matrix in the box marked "Start". Follow each of the given row operations and shade the box that contains your result for each one (each row operation is carried out on the previous answer). At the "pit stop" you'll get a new matrix to use.



You can escape this matrix by "rowing" your way to freedom!

1. $-2R_2 \to R_2$
2. $R_2 + R_3 \to R_3$
3. $2R_1 + R_2 \to R_2$
4. $-\frac{3}{4}R_2 \to R_2$
5. $R_2 + R_3 \to R_3$
6. $-\frac{1}{3}R_2 \to R_2$ **(P.S.)**
7. $R_1 \leftrightarrow R_3$
8. $R_1 + (-2)R_2 \to R_2$
9. $R_2 + 2R_3 \to R_3$
10. $-1R_3 \to R_3$
11. $-\frac{1}{2}R_2 \to R_2$
12. $\frac{1}{4}R_1 \to R_1$

START $\begin{bmatrix} 1 & 1 & 1 & 0 \\ 1 & -1 & 1 & -6 \\ 2 & 1 & 3 & -2 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ -2 & 2 & -2 & 12 \\ 2 & 1 & 3 & -2 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ -2 & 2 & -2 & 12 \\ 0 & 3 & 1 & 10 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 4 & 0 & 12 \\ 0 & 3 & 1 & 10 \end{bmatrix}$
$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 1 & -1 & 1 & -6 \\ -4 & -2 & -6 & 4 \end{bmatrix}$	$\begin{bmatrix} -1 & 3 & -1 & 12 \\ -2 & 2 & -2 & 12 \\ 2 & 1 & 3 & -2 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & -1 & 0 & -3 \\ 0 & 0 & 1 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & -3 & 0 & -9 \\ 0 & 3 & 1 & 10 \end{bmatrix}$
$\begin{bmatrix} 4 & 2 & 1 & 5 \\ 2 & 2 & 2 & 2 \\ 0 & 1 & 1 & 1 \end{bmatrix}$	**PIT STOP** $\begin{bmatrix} 0 & 1 & 1 & 1 \\ 2 & 2 & 2 & 2 \\ 4 & 2 & 1 & 5 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & -3 & 0 & -9 \\ 0 & 0 & 1 & 1 \end{bmatrix}$
$\begin{bmatrix} 4 & 2 & 1 & 5 \\ 0 & -2 & -3 & 1 \\ 0 & 1 & 1 & 1 \end{bmatrix}$	$\begin{bmatrix} 0 & 1 & 1 & 1 \\ 2 & 2 & 2 & 2 \\ 4 & 3 & 2 & 6 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 3 & 0 & 9 \\ 0 & 0 & 1 & 1 \end{bmatrix}$
$\begin{bmatrix} 4 & 2 & 1 & 5 \\ 0 & -2 & -3 & 1 \\ 0 & 0 & -1 & 3 \end{bmatrix}$	$\begin{bmatrix} 4 & 2 & 1 & 5 \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \\ 0 & 0 & 1 & 0 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{2} & \frac{1}{4} & \frac{5}{4} \\ 0 & 1 & \frac{3}{2} & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{2} & \frac{1}{4} & 0 \\ 0 & 1 & \frac{3}{2} & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$
$\begin{bmatrix} 4 & 2 & 1 & 5 \\ 0 & -2 & -3 & 1 \\ 0 & 0 & 1 & -3 \end{bmatrix}$	$\begin{bmatrix} 4 & 2 & 1 & 5 \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \\ 0 & 0 & 1 & -3 \end{bmatrix}$	$\begin{bmatrix} 1 & \frac{1}{2} & \frac{1}{4} & \frac{5}{4} \\ 0 & 1 & \frac{3}{2} & -\frac{1}{2} \\ 0 & 0 & 1 & -3 \end{bmatrix}$	**You've successfully "rowed" to freedom!**

Student Activity

Match Up on Basic Exponent Rules

Match-up: Match each of the expressions in the squares of the grid below with an equivalent simplified expression from the top. If an equivalent expression is not found among the choices A through D, then choose E (none of these).

A x^5

B x^6

C $9x^4$

D $12x^6$

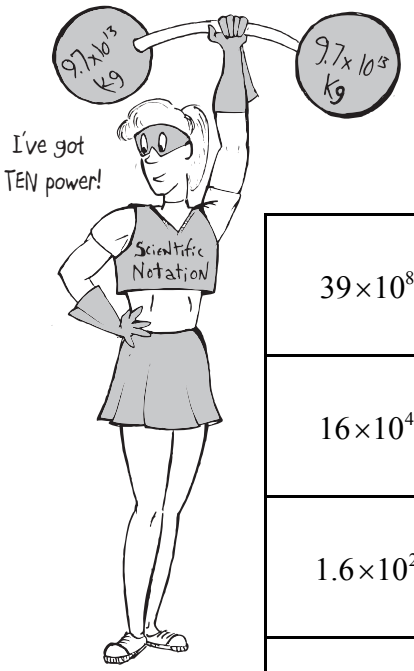
E None of these

$(6x^2)(2x^4)$	$4x^4-(-5x^4)$	$x^3\cdot x^2$	$(-3x^3)(-3x)$	$x^5\cdot x$
$6x^3+6x^3$	$-4x^5+5x^5$	$12(x^2)^3$	$(-3x^3)(-4x^3)$	x^5+x
$(x^2)(x^2)(x)$	$(27x^3)\left(\frac{1}{3}x\right)$	$(x^3)^2$	$(12x^3)^2$	$(-3x^2)^2$
$(3x^2)^2$	$3(-2x^3)^2$	$3x^3+6x$	$(5x^2)\left(\frac{1}{5}x^3\right)$	$8x^6+4x^6$

Student Activity

Escape the Matrix with Ten Power

Directions: Begin at the box marked START. By shading in pairs of adjacent squares that represent equal numbers, you will eventually find the path to "escape" this matrix of boxes. The first "step" in the path and two of the middle steps in the path have been shaded for you.



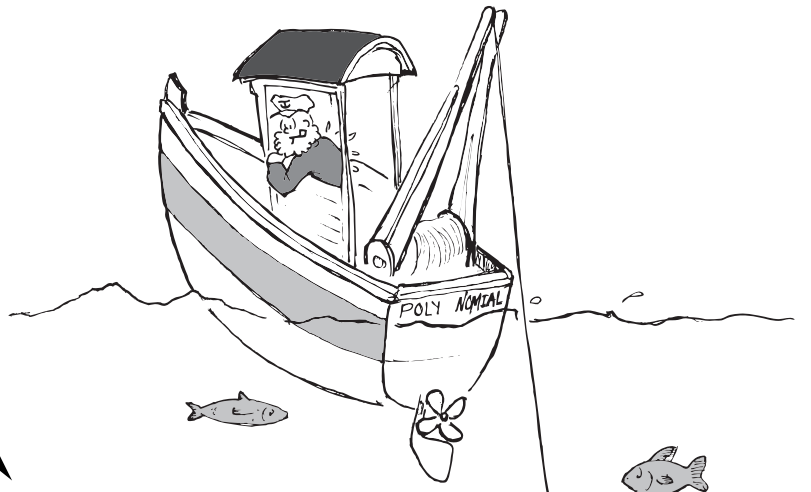
START 0.00043	4.3×10^{-4}	5×10^{6}	$5,000,000$	7.6×10^{3}
	4.3×10^{-3}	$500,000$	5.0×10^{7}	50×10^{6}
	789×10^{-2}	7.89	0.023	2.3×10^{-2}
39×10^{8}	$390,000,000$	3.90×10^{7}	2.3×10^{2}	$23,000$
16×10^{4}	3.90×10^{8}	$1,000,000$	10×10^{5}	5.555×10^{-3}
1.6×10^{2}	0.00016	1×10^{5}	10×10^{3}	0.005555
$32,300$	32.30×10^{5}	3.230×10^{6}	0.003230×10^{6}	3230
3.230×10^{4}	6.89×10^{4}	689	689×10^{-1}	323×10^{0}
323.0×10^{-2}	3.230	32.30	3.230×10^{1}	**ESCAPE** the Matrix

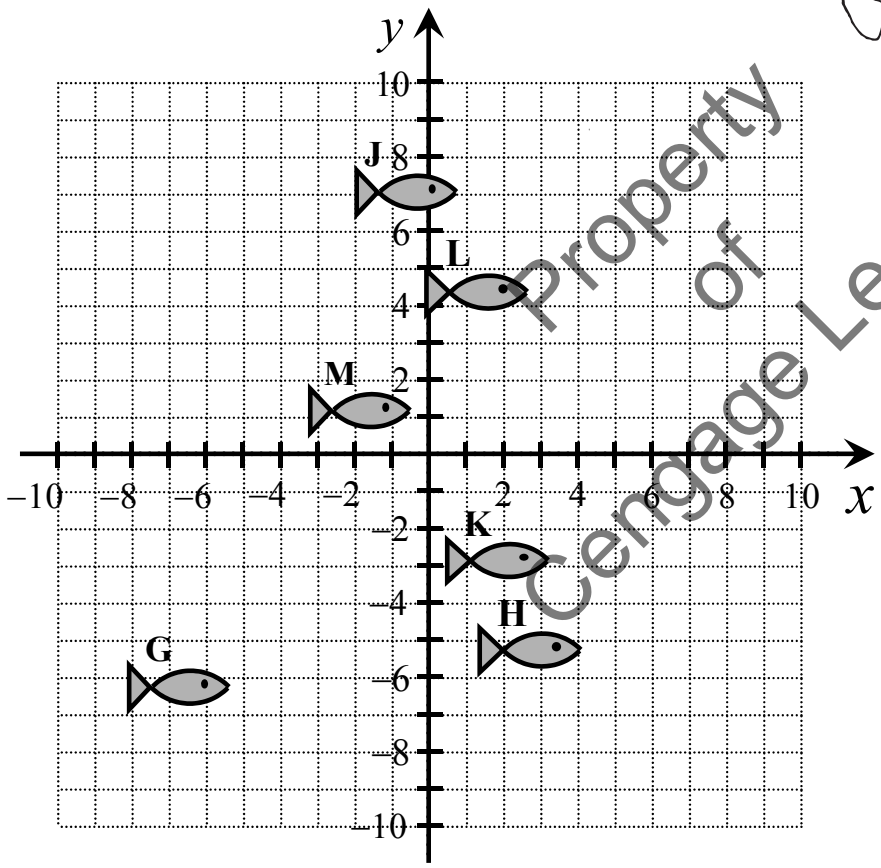
Student Activity

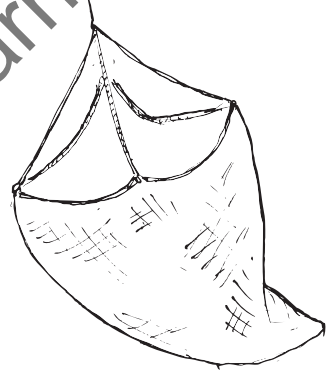
Caught in the Net

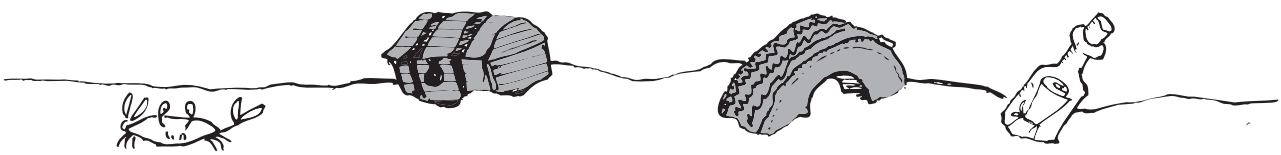
Directions: Which fish get "trapped" between the two nets?

Graph $y = \frac{1}{9}x^3 + 1$ and $y = -\frac{3}{4}x^2 + 10$ (the "nets") to find out.









Student Activity

Match Up on Polynomial Division

Directions: Match each of the expressions in the squares of the grid below with an equivalent simplified expression from the top. If an equivalent expression is not found among the choices A through D, then choose E (none of these). Be careful – you may have to simplify rational expression terms.

A $x+4$ **B** $2x-3$ **C** $x+4+\dfrac{3}{x-1}$ **D** $2x-3-\dfrac{4}{x+3}$ **E** None of these

$x-1\overline{)x^2+3x-1}$	$x+7\overline{)x^2+11x+28}$	$x+3\overline{)x^2+7x+8}$
$x+3\overline{)2x^2+3x-9}$	$(4x^2+6x-26)\div(2x+6)$	$(x^2+7x+16)\div(x+3)$
$(x^2-16)\div(x-4)$	$\dfrac{6x^2y+2x^3y}{2x^2y}$	$\dfrac{36a^2b^2cx-54a^2b^2c}{18a^2b^2c}$

Student Activity

The First Factoring Matchup

Directions (READ them): In each box of the grid, you will find an expression that needs to be factored. Once you have factored each expression, look to see whether the factor appears in the list at the top. If it does, list that letter, if none of the factors are listed, then choose F (none of these are factors). The first one has been done for you. Some boxes may have more than one answer.

A $x+3$ **B** $x-2$ **C** $x+2y$ **D** $y-5$ **E** $x+4$ **F** None of these are factors

$x^2-3x+2xy-6y$ $x(x-3)+2y(x-3)$ Ans: $(x+2y)(x-3)$ C	$3x^2y^2+9xy^2$	$4xy^4+8y^4$	$xy+3y-5x-15$
$x^2+4x+2xy+8y$	$3x^2y^2z^3-6xy^2z^3$	$xy+4y-5x-20$	$7xy-14y-3x+6$
$6xy^2+10y^2+3xy+5y$	$x^2+3x+2xy+6y$	$3a^2b^3x+12a^2b^3$	$10x^2y-50x^2+9xy-45x$
$xy+3y-2x-6$	$x^2+2xy+2xy+4y^2$	$xy+2y^2-5x-10y$	$xy-2y-5x+10$

Student Activity

Escape the Matrix by Solving Quadratic Equations

Directions: In each box of the grid, you will find a quadratic equation that needs to be solved. Once you have solved the equations, use pairs of matching solution numbers to navigate your way out of the matrix. The first one has been done for you. For example, the repeated solution of -3 leads you to the box on the right, with solutions of -3 and 4. To move the next step on the escape route, you need to find an adjacent box with a solution of 4 and something else.

START HERE Solve: $(x+3)^2=0$ Solutions: -3 and -3	Solve: $x^2-x-12=0$ $(x-4)(x+3)=0$ Solutions 4 and -3	Solve: $x^2-8x-48=0$	Solve: $(x+12)^2=0$
Solve: $x^2+2x-8=0$	Solve: $(x-4)(x-\frac{1}{2})=0$	Solve: $x^2-\frac{5}{6}x+\frac{1}{6}=0$	Solve: $3x^2-19x+6=0$
Solve: $x^2-8x+15=0$	Solve: $x^2-x-42=0$	Solve: $x^2+x=2$	Solve: $(x-6)(x+2)=0$
ESCAPE the Matrix Solve: $x^2+8x+16=0$	Solve: $x^2-16=0$	Solve: $x^2-5x+4=0$	Solve: $x^2-11x=-24$

Student Activity

Tic-Tac-Toe on Complex Fraction Pieces

Directions: In every box in the tic-tac-toe grid, there is a rational expression and a simplified form. If the two are equivalent, then circle the simplified form (thus placing an **O** on the square). If the expression has **not** been simplified correctly, then put an **X** over the incorrect simplification.

Tic-tac-toe Game#1:

$x^2\left(\frac{3}{x}\right)$ $3x$	$(2-x)\left(\frac{1}{x-2}\right)$ -1	$\left(\frac{2}{x}\right)\left(\frac{x^2}{4}\right)$ $2x$
$\left(24x^3\right)\left(\frac{3}{8x^2}\right)$ $9x$	$(15x)\left(\frac{4}{25x^2}\right)$ $\frac{4}{5x}$	$\left(\frac{x+3}{2(x-3)}\right)(x-3)$ $\frac{x+3}{2}$
$\left(\frac{3-2x}{x^3}\right)\left(x^3\right)$ $3x^3-2x^4$	$\left(81x^4\right)\left(\frac{9}{9x^4}\right)$ 81	$\left(\frac{1}{x-1}\right)(1-x)$ 1

Tic-tac-toe Game#2:

$\left(8x^2\right)\left(\frac{3}{4x}-2\right)$ $6x-16x^2$	$x^2\left(\frac{5}{x^2}-\frac{2}{x}\right)$ $5-\frac{2}{x}$	$x^3\left(\frac{5}{x^2}+4x\right)$ $5x+4x^2$
$x\left(4+\frac{x+1}{x}\right)$ $5x+1$	$\left(\frac{x}{5}\right)\left(\frac{25}{x}+5\right)$ $5+5x$	$\left(\frac{x^2}{3}\right)\left(6-\frac{9}{10x^2}\right)$ $2x^2-\frac{3}{10}$
$\left(32x^4\right)\left(\frac{1}{16x}-\frac{1}{32x^4}\right)$ $2x^3-1$	$\left(\frac{24x}{y}\right)\left(\frac{y}{8x}-y\right)$ $3-24x$	$\left(42x^2\right)\left(\frac{1}{6x}+\frac{1}{7x}\right)$ 5

Student Activity

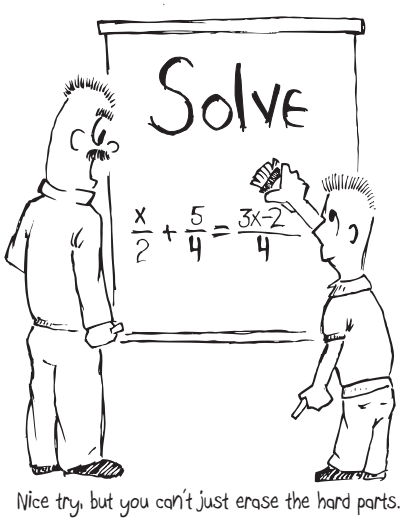
Match Up on Simple Rational Equations

Directions: Solve each rational equation and check the result. Then choose the letter that corresponds to this result. Some problems may have more than one answer. If there is no solution, then choose E (No Solution). If the result is not among the choices, then choose F (None of these). The first one has been done for you.

A 2 **B** -1

C 1 **D** $\frac{1}{2}$

E No Solution **F** None of These



$\frac{5x+5}{x+4}=2$ $5x+5=2(x+4)$ $5x+5=2x+8$ $3x=3$ $x=1$ **(C)**	$3=\frac{8-x}{x+2}$	$\frac{4x-2}{x+2}=4$
$\frac{x-3}{2x+3}=5$	$\frac{3}{x}+\frac{4}{x+2}=-\frac{1}{x}$	$\frac{5}{2}=\frac{11+x}{x+5}$
$\frac{x+2}{x-4}=\frac{2}{x-3}$	$\frac{x-4}{x+1}=-\frac{2x+7}{(x+2)(x+1)}$	$\frac{3x^2+5}{7x+5}=2$

Student Activity

Escape the Rational Exponent Matrix

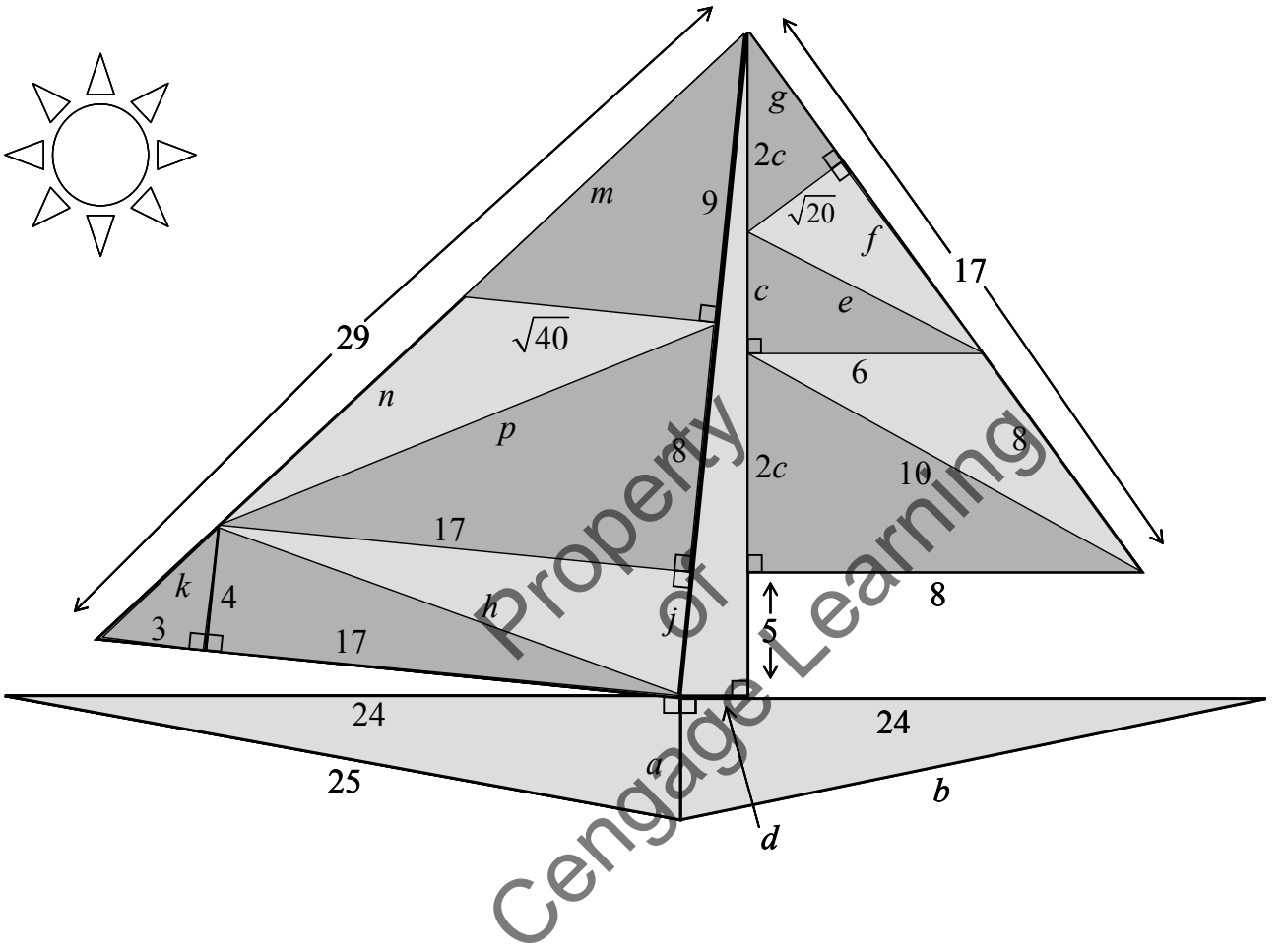
Directions: Assume all variables represent positive numbers. Begin at the box marked START. By shading in adjacent pairs of squares that contain equivalent expressions, you will eventually find the path to "escape" this matrix of boxes. The first "step" in the path and a couple steps in the middle have been taken for you.

START $\left(36b^6\right)^{1/2}$	$18b^3$	$9b^3$	$x+\sqrt{x}$	$7^{2/3}$
$6b^3$	$36b^3$	$3y$	$\sqrt[4]{3y}$	$x^{9/5}$
$x^{3/4}\cdot x^2$	$\sqrt[4]{x^{11}}$	$\left(3y^{2/3}\right)^3$	$9y^2$	$\left(\sqrt{2x}\right)^3$
$\sqrt{x^3}$	$x^{4/11}$	$27y^2$	$\sqrt[3]{3y^2}$	$2x^{4/3}$
$x^{4/3}$	$x^{-4/3}$	$\frac{x^3}{x^{7/3}}$	$\sqrt[3]{x^2}$	$x^{5/6}\left(x^{1/6}+x^{1/2}\right)$
$x^{1/3}$	$\frac{1}{x^7}$	x^7	$x^{1/9}$	$x+\sqrt[3]{x^4}$
7	$\frac{x^3}{8}$	$\left(\frac{x^5}{32}\right)^{3/5}$	$y^{1/20}$	$\sqrt[4]{\sqrt[5]{y}}$
$\frac{1}{y^2}$	$\sqrt[10]{y^5}$	y^2	$y^{5/4}$	y^{20}
$3\sqrt{y}$	$y^{1/2}$	49	**ESCAPE** $343^{2/3}$	$\sqrt{y^{400}}$

Student Activity

Sail Into the Pythagorean Sunset

Directions: Almost all of the triangles in the figure below are right triangles. Using the sparse information you are given and the Pythagorean Theorem, work out the lengths of all the missing sides in the sailboat below. You should be able to work out the sides of the non-right triangles by piecing together the information you find from the right triangles. It might be helpful to start by finding the measure of a.



$a =$

$b =$ $h =$

$c =$ $j =$

$d =$ $k =$

$e =$ $m =$

$f =$ $n =$

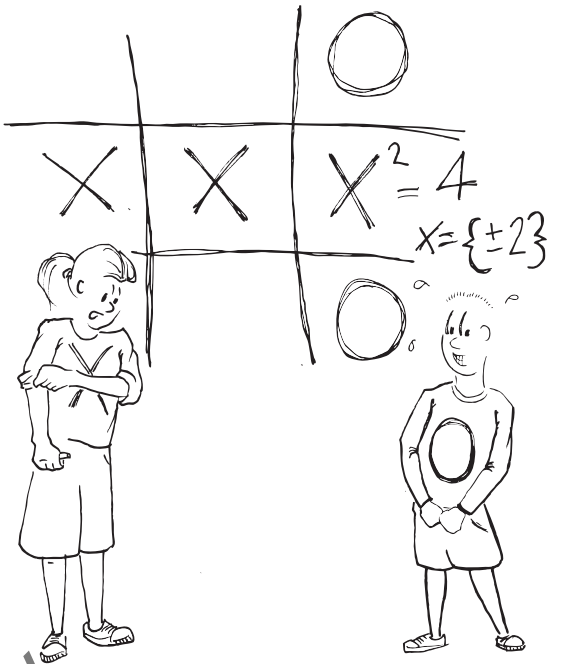
$g =$ $p =$

Student Activity

Square Isolation Tic-Tac-Toe

The square root property can be used to solve a quadratic equation if

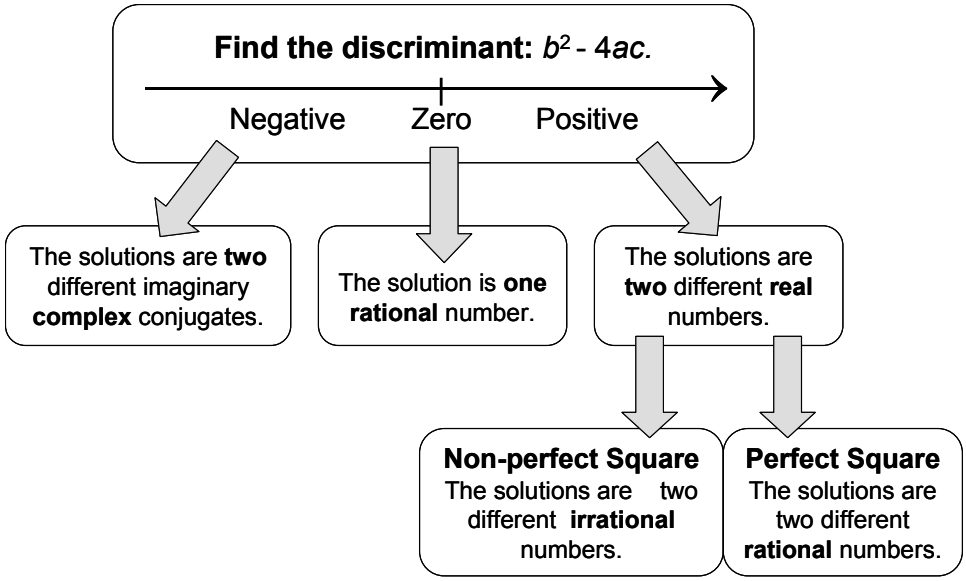
1) you can isolate the part of the equation that is written as a square.
2) the only variables in the equation are in the squared part.



Directions: If the equation **can** be solved easily with the square root property using the rules above, then isolate the squared part, and circle the equation (placing an O on the square). If the equation cannot be easily solved with the square root property, then place an X on the square.

$3(x+2)^2 - 25 = 50$	$x^2 = 5x - 4$	$-5(3x-1)^2 = -45$
$3x^2 = 75$	$24 = (x+7)^2 + 8$	$x^2 + 8x - 20 = 0$
$16x^2 - 24x = -9$	$(x-3)^2 + 2x = 0$	$x^2 + 6x = 2(3x+2)$

Student Activity
Match Up on the Discriminant



Directions: In each box, find the discriminant and then classify it.

A Two different rational numbers **B** Two different irrational numbers **C** One rational number **D** Two different imaginary numbers

$25x^2 - 40x + 16 = 0$ $d = (-40)^2 - 4(25)(16) = 0$ **C**	$3x^2 + 14x - 24 = 0$	$x^2 - 2x + 2 = 0$
$9x^2 = 4$	$6x^2 - 3 = 0$	$x^2 + 3 = 5x$
$5(5x^2 + 2x) = -1$	$2x^2 + 3x = -3$	$3x^2 + 11x = 5$
$45x^2 + 24 = 67x$	$144x^2 - 264x + 121 = 0$	$4x^2 + 36x = -81$

Student Activity

Exponential Workout

Directions: For each expression, simplify and then find and shade the box with its equivalent form in the grid.

1. $\left(e^{\sqrt{2}}\right)^{\sqrt{2}}$

2. $\dfrac{2}{\sqrt{2}}$

3. $\dfrac{10^{3\sqrt{4}}}{10^{2\sqrt{4}}}$

4. e^{-1}

5. $\dfrac{6^7}{6^3 \cdot 36}$

6. $\left(\dfrac{1}{3}\right)^{-1}$

7. $\left(e^2\right)^{3/2}$

8. $\left(\sqrt{13}\right)^4$

9. $7^{36}7^{-34}$

10. $3460\left(\dfrac{1}{50}\right)^2$

11. $\dfrac{1}{\left(|-2|\right)^{-99}}$

12. $1-\dfrac{e^0}{9}$

13. $\left(\dfrac{1}{e}\right)^{-1}$

14. $\left(5^{2\sqrt{5}}\right)^3$

15. $\left(9^4\right)^{1/2}$

16. $0.001\left(10^3\right)$

17. $10^x \cdot 10^{3x}$

18. $(4e)^{1/2}$

19. $\dfrac{6^{\sqrt{3}+2\sqrt{2}}}{6^{\sqrt{8}}}$

20. $2(256)^{-1}2^8$

21. $3^x - \dfrac{1}{3^{-x}}$

22. $\dfrac{e^2}{e^{-3}}$

1	e	$2\sqrt{e}$	$2^{2\sqrt{2}}$	4^{4x}	27^{12}	14	99	36		2
3	-2	$9^{\sqrt{2}}$		e^2		49		$6^{\sqrt{3}}$	34	e^3
	$5^{6\sqrt{5}}$	0		5	$\dfrac{8}{9}$	$\dfrac{1}{4}$	$\dfrac{2}{3}$	81	1.384	
2^{99}	10		$\dfrac{1}{2}$	$\dfrac{1}{e}$	$\dfrac{6^4}{36}$	10^{4x}		169	3^{2-x}	9
$\sqrt{2}$	100		8^x	9	$-\dfrac{1}{3}$		-4	e^5	$2^{2\sqrt{2}}$	

Student Activity

Paint by Equivalent Equations

Directions: Write each logarithmic equation as its corresponding exponential equation. Write each exponential equation as its corresponding logarithmic equation. Shade in your answers in the grid to reveal the picture. The first one has been done for you.

1. $5^3 = 125$
$\log_5 125 = 3$

2. $2^x = 8$

3. $\log x = 2$

4. $\log_4 64 = 3$

5. $10^x = \frac{1}{100}$

6. $16^x = 2$

7. $\log_3 x = -1$

8. $\log 1 = 0$

9. $4^{-x} = 2$

10. $\left(\frac{1}{2}\right)^x = 4$

11. $x^2 = 9$

12. $\log 1000 = x$

13. $\log_x 25 = 2$

14. $x^0 = 1$

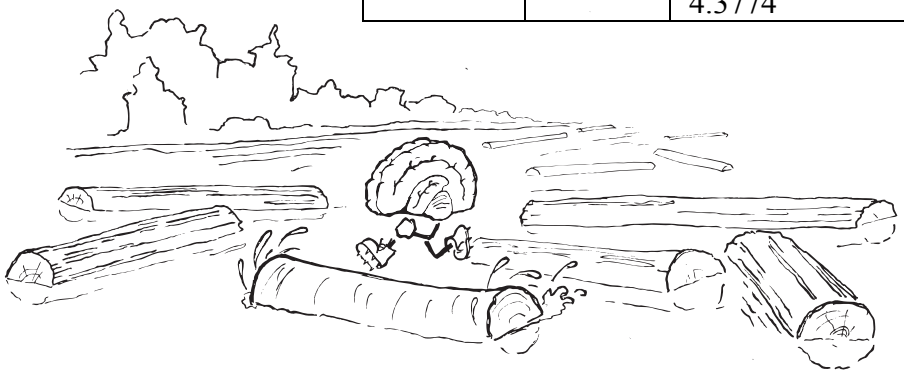
15. $\left(\frac{1}{9}\right)^x = 3$

$\log_x 9 = 2$	$\log_2 9 = x$	$\log_x 3 = \frac{1}{9}$		$\log_5 125 = 3$	$\log_1 x = 0$	$\log \frac{1}{100} = x$
$10^2 = x$	$2^{10} = x$	$x = \log_8 2$		$\log_2 4 = -x$	$\log_{1/2} 4 = x$	$\log x = \frac{1}{100}$
$\log_{1/9} 3 = x$	$\log_x 1 = 0$	$\log_2 8 = x$		$\log_4 2 = -x$	$\log_4 x = 4$	$10^0 = 1$
$3^{-1} = x$	$x^{-1} = 3$	$4^3 = 64$		$3^4 = 81$	$\log_4 \frac{1}{2} = x$	$\log_3 x = \frac{1}{9}$
$10^x = 1000$	$x^2 = 25$	$\log_{16} 2 = x$		$\log_2 16 = x$	$25^x = 2$	$2^x = 25$

Student Activity
Escape the Logjam

Directions: Begin at the box marked START. Either solve the equation or simplify the expression. Look for the result in the movement grid to the right. If your result is not in the movement grid, that's a BAD sign. For example, the answer to $3^x = 7$ is $x \approx 1.7712$, so we move to the right. Next solve $\log(3 - x) = 3$.

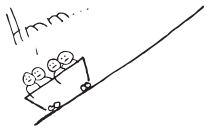
Move Left	Move Right	Move Down	
0.0025	~~1.7712~~	3.4190	1.0986
23.1331	0.4474	0.7906	8
	2.4022	2	–2
	0.2091	–997	10
		4.3774	



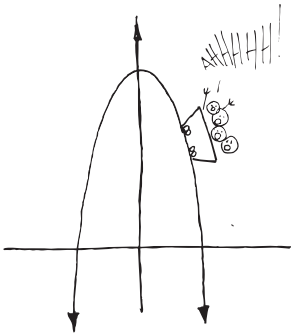
START $3^x = 7$ $\rightarrow \rightarrow \rightarrow$	$\log(3 - x) = 3$	$e^0 + e^x$
$4^x = 16$	$4^{x-2} = 27$	$\log_5 25 = x$
$e^{-2.4t} = 14.2$	$e^{2.8x} = 3.5$	$\log_2(x - 7) + \log_2 x = 3$
$e^{3x} = 60$	$\log 8 - \log x = 2$	$2^{x+2} = 3^x$
$3^{x^2-3x+4} = 81$	$2^x = 16$	$\log 3x = \log 6$
$\log 5 - \log 2x = 0.5$	$5^x = 7^{x-4}$	$\log \frac{2x}{5} = -3$
$e^{2x} = 9$	$\ln x = 5$	$\log_2 5x - \log_2 3 = 4$
$3^x - 11 = 3$	$5^{x+1} = 7$	$\log x^{900} = 900$
$\frac{1}{3}\log(3x + 5) = \log x$	$\ln 5x = 4$	$6^{x+4} = 36$
$3^{9y-3} = 1$	$z + \ln e^{-z}$	**ESCAPE** the logjam

Student Activity

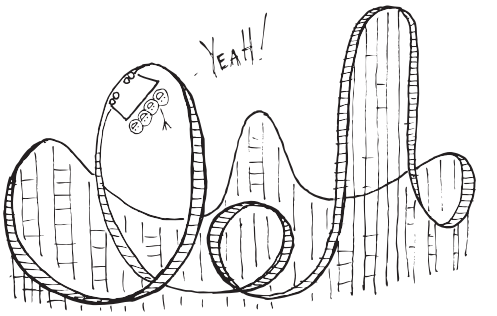
Name that Conic!



$y = x$



$y = 10 - x^2$



... Conics are the BEST!!!!!!

Match-up: Match each of the equations in the squares of the grid below with the conic classification. You may have to rearrange or simplify equations to determine their classification.

A Circle
B Ellipse
C Parabola opening up or down
D Parabola opening right or left
E Hyperbola opening right and left
F Hyperbola opening up and down
G Something else

$\frac{x^2}{25} - \frac{y^2}{9} = 1$	$x = y^2 + 1$	$x^2 + 4y^2 = 4$
$x^2 + 3(y-3)^2 = 9$	$x^2 + (y-3)^2 = 1$	$x^2 + (y-3)^2 = 9$
$y - (x-4)^2 = 5$	$y = \frac{3}{x}$	$9(y-4)^2 - 4(x+1)^2 = 36$
$x + (y+9)^2 = 3$	$x^2 + y^2 = 1$	$x^2 + 4x - y^2 + 2y = 6$
$x^2 + 5x + 3 - (x^2 + 2x) = y$	$25x^2 + 100x - 4y^2 = 100$	$\frac{x^2}{4} + \frac{y^2}{4} = 1$

Student Activity
Paint by Factorials

Directions: Evaluate each of the factorial expressions by simplifying first. Then shade in the box in the grid that corresponds to the simplified expression.

Example: $\frac{8!}{5!} = \frac{8\cdot7\cdot6\cdot5\cdot4\cdot3\cdot2\cdot1}{5\cdot4\cdot3\cdot2\cdot1} = \frac{8\cdot7\cdot6\cdot\cancel{5}^{1}\cdot\cancel{4}^{1}\cdot\cancel{3}^{1}\cdot\cancel{2}^{1}\cdot\cancel{1}^{1}}{\cancel{5}^{1}\cdot\cancel{4}^{1}\cdot\cancel{3}^{1}\cdot\cancel{2}^{1}\cdot\cancel{1}^{1}} = 8\cdot7\cdot6 = 336$

1. Evaluate: $5!$

2. Evaluate: $\frac{100!}{99!}$

3. Evaluate: $\frac{99!}{100!}$

4. Evaluate: $\frac{4!}{0!}$

5. Evaluate: $\frac{10!}{8!(10-8)!}$

6. Evaluate: $4!\cdot3!$

7. Evaluate: $\frac{9!}{6!(9-6)!}$

8. Evaluate: $\frac{2!\cdot3!}{6!}$

9. Evaluate: $\frac{12!}{9!\cdot3!}$

10. Evaluate: $\frac{9!\cdot8!}{7!\cdot10!}$

1	100	24	3
5	$\frac{1}{100}$	$\frac{1}{60}$	$\frac{7}{2}$
0	220	120	2
$\frac{1}{3}$	$\frac{4}{5}$	144	$12!$
$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{12}$	12
$10!$	84	45	undefined