Algebra 1 Sample Problems:

1. Combining fractions (add/subtract, multiply/divide, simplify)

Example 1:

i. $1+\frac{4}{9}$

ii. $\left(\frac{9}{9}\right)1+\frac{4}{9}$

iii. $\frac{9+4}{9}$

iv. $\frac{13}{9}$

Example 2:

i. $\frac{1/12}{3/4}$

ii. $\frac{1}{12}\cdot\frac{4}{3}$

iii. $\frac{4}{36}=\frac{4}{4x9}$

iv. $\left(\frac{4}{4}\right)\frac{1}{9}$

v. $\frac{1}{9}$

2. Converting from one linear form to another

Find the equation of the line that passes through (2,3) with a slope of -5

i. $y-y_1=m(x-x_1)$ Point-Slope Form

ii. $y-3=-5(x-2)$

iii. $y-3=-5x+10$

iv. $y=-5x+13$ Slope-Intercept Form

v. $5x+y=13$ Standard Form

3. Multiplying powers with like bases

Given:

i. $x^2\cdot x^{a-2}$

ii. x^{2+a-2} Add exponents

iii. x^a Simplify

4. Dividing powers with like bases

Given:	i.	$\frac{5^x}{5^{x+2}}$	
	ii.	$5^{x-(x+2)}$	Subtract exponents
	iii.	5^{x-x-2}	
	iv.	5^{-2}	Simplify
	v.	$\frac{1}{5^2}$	Simplify

5. Raising a product or a quotient to a power

Given:	i.	$(a^2b^3)^5$	
	ii.	$a^{2\cdot 5}b^{3\cdot 5}$	Multiply exponents
	iii.	$a^{10}b^{15}$	Simplify

6. Factoring trinomials

This example uses a trinomial where the lead coefficient is other than "1". The method employed here is called the "bottoms up" method.

i.	$3x^2+10x-8$	Given
ii.	$x^2+10x-24$	Multiply the constant by the leading coefficient
iii.	$(x+12)(x-2)$	Factor as if the leading coefficient were "1"
iv.	$(x+\frac{12}{3})(x-\frac{2}{3})$	Divide the constants by the original coefficient
v.	$(x+4)(x-\frac{2}{3})$	Simplify each fraction.
vi.	$(x+4)(3x-2)$	Move any denominator for each binomial into the lead coefficient position. Check the resulting factors by using FOIL.

7. Simplifying complex rational expressions

i. $\frac{x-2}{x-2}+\frac{x+2}{x^2-4}$

ii. $\frac{x-2}{x-2}+\frac{x+2}{(x+2)(x-2)}$

iii. $\left(\frac{x+2}{x+2}\right)\frac{x-2}{x-2}+\frac{x+2}{(x+2)(x-2)}$

iv. $\frac{x^2-4+x+2}{(x+2)(x-2)}$

v. $\frac{x^2+x-2}{(x+2)(x-2)}$

vi. $\frac{(x+2)(x-1)}{(x+2)(x-2)}$

vii. $\frac{x-1}{x-2}$

8. Solving problems involving distance/rate/time

Example: *A train leaves Sacramento at a speed of 60 kilometers per hour. Two hours later another train leaves Sacramento on a parallel track at 90 kilometers per hour. At what point will the second train catch up to the first train?*

a) Fill in the chart above with the correct information:

	DISTANCE	RATE	TIME
First Train	(the distance equals the distance below) or d	60	x
Second Train	(the distance equals the distance above) or d	90	x-2

b) Since it is known that $d = rt$ (Distance = Rate x Time), the first train's distance will be equal to $d = 60x$. The second train's distance will be equal to $d = 90(x-2)$.

c) $d = d$ because that is the distance where the second train catches the first train.

d) Logically, if $d = d$, then substitute $60x$ and $90(x+2)$ for those values, or $60x = 90(x-2)$.

e) Solve:

i. $d = d$

ii. $60x = 90(x-2)$.

iii. $60x = 90x-180$

iv. $-30x = -180$

v. $x = 6$

f) The first train will have traveled 6 hours at 60 miles per hour or 360 miles. The second train will have traveled 4 hours at 90 miles per hour or 360 miles.

9. Using the elimination method solve a linear system

Given:

i. $2x + 5y = 8$
$x - 3y = 2$

ii. $2x + 5y = 8$
$2(x - 3y) = 2(2)$ — Multiply 2nd equation by 2

iii. $2x + 5y = 8$
$2x - 6y = 4$ — Subtract 2nd equation from 1st

$11y = 4$

iv. $y = \frac{4}{11}$ — Solve for y

Now substitute into either equation to find *x*. . .

v. $2x + 5(\frac{4}{11}) = 8$

vi. $2x + \frac{20}{11} = 8$

vii. $2x\left(\frac{11}{11}\right) + \frac{20}{11} = 8\left(\frac{11}{11}\right)$ — Common denominator

viii. $22x + 20 = 88$

ix. $22x = 68$

x. $x = \frac{68}{22} or \frac{34}{11}$

Check your answer.

10. Dividing radical expressions

Given:

i. $\frac{\sqrt[3]{25a^2b^5}}{\sqrt[3]{5ab}}$

ii. $\sqrt[3]{\frac{25a^2b^5}{5ab}}$

iii. $\sqrt[3]{5a^{2-1}b^{5-1}}$

iv. $\sqrt[3]{5ab^4}$

v. $5^{1/3}a^{1/3}b^{4/3}$

vi. $b\sqrt[3]{5ab}$

11. Rationalizing denominators

Given:

i. $\frac{4}{\sqrt{3}+x}$

ii. $\frac{4}{\sqrt{3}+x}\left(\frac{\sqrt{3}-x}{\sqrt{3}-x}\right)$

iii. $\frac{4\sqrt{3}-4x}{3-x\sqrt{3}+x\sqrt{3}-x^2}$

iv. $\frac{4\sqrt{3}-4x}{3-x^2}$

12. Graphing parabolas

Sketch $g(x)=4x^2+8x-3$

Change the quadratic equation to the $a(x-h)^2+k=y$ form.

Part One:

i.	$g(x)=4x^2+8x-3$	Remember $g(x)=y$
ii.	$4x^2+8x-3=0$	Make $y=0$
iii.	$4x^2+8x=3$	Add the constant term to both sides of the equation.
iv.	$4(x^2+2x+...)=3$	Factor out the 4, complete the square.
v.	$4(x^2+2x+1)=3+4(1)$	Complete the square and add the right amount to both sides of the equation.
vi.	$4(x+1)^2=7$	Factor the trinomial and change to $a(x-h)^2+k=y$ form.
vii.	$4(x+1)^2-7=0$	

The a-value is a +4 so the direction of the parabola opens upward. The (h,k) is (-1,-7) so the vertex is in the third quadrant. There will be two x-intercepts.

Part Two:

To find x-intercepts. . .

i.	$4(x+1)^2-7=0$	To find x-intercepts, make y = 0.
ii.	$(x+1)^2=\frac{7}{4}$	Add +7 to both sides, divide by 4.
iii.	$\sqrt{(x+1)^2}=\frac{\sqrt{7}}{\sqrt{4}}$	To “undo” a square, take the square root.
iv.	$x+1=\pm\frac{\sqrt{7}}{2}$	Remember the square root is plus/minus.
v.	$x=+0.3$ or $x=-2$	Subtract +1 from each side, estimate $\frac{\sqrt{7}}{2}$ and get the two roots.

To find the y-intercept. . .

i.	$4(0+1)^2-7=y$	Make x = 0
ii.	$4-7=y$	Simplify
iii.	$-3=y$	The parabola crosses the y-axis at (0,-3).

Sketch the graph: