CCAC ELEMENTARY ALGEBRA

Sample Questions

TOPICS TO STUDY:

Evaluate expressions
Add, subtract, multiply, and divide polynomials
Add, subtract, multiply, and divide rational expressions
Factor two and three termed expressions
Solve literal, linear, and quadratic equations
Solve linear inequalities
Linear equations in two variables
Exponent laws
Simplify radicals
Rationalize denominators

Answers and Rationale – Pages 9-13

1. Evaluate $\frac{a^2 - b^2}{a - b}$ when $a = 4$ and $b = -2$.

   a. 4
   b. 10
   c. 2
   d. $\frac{10}{3}$
   e. -2

2. Simplify $-7x + 3[x - (3 - 2x)]$.

   a. $16x + 9$
   b. $2x - 9$
   c. $-21x^2 + 30x - 9$
   d. $-2x - 9$
   e. $-16x - 9$
   f. $16x + 9$
   g. $\frac{9}{2}$

3. Find the solution of the following:
   $3[2 - 4(2x - 1)] = -2(-2x + 5)$.

   a. 1
   b. 0
   c. -1
   d. $\frac{1}{7}$
   e. 7

4. Simplify
   $(3x^2 + 2x - 5) - (x^2 + 4x - 12)$.

   a. $2x^2 - 2x + 7$
   b. $2x^2 + 6x - 17$
   c. $4x^2 + 6x - 17$
   d. $2x^2 - 6x - 7$
   e. $2x^2 + x - 7$

5. Solve $5x - 2y = 10$ for y.

   a. $y = 5x - 5$
   b. $y = -5$
   c. $y = -5x - 10$
   d. $y = \frac{5}{2}x - 5$
   e. $y = -\frac{5}{2}$

6. Solve $S = a + (n - 1)d$ for n.

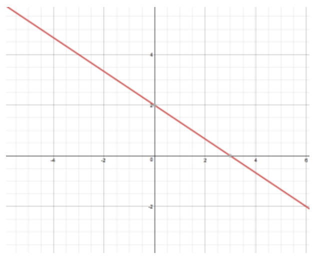
   a. $n = \frac{S + a - d}{d}$
   b. $n = \frac{S - a + d}{d}$
   c. $n = S + 1 - a$
   d. $n = Sa$
   e. $n = \frac{Sda}{d}$

7. Solve $R = \dfrac{C - S}{t}$ for S.

a. $S = C - Rt$
b. $S = CRt$
c. $S = C + Rt$
d. $S = Rt - C$
e. $S = R + St$

8. Graph $2x + 3y = 6$

a.



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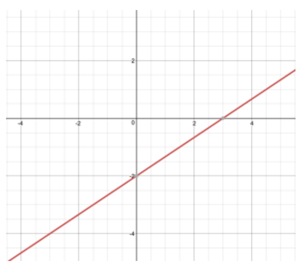

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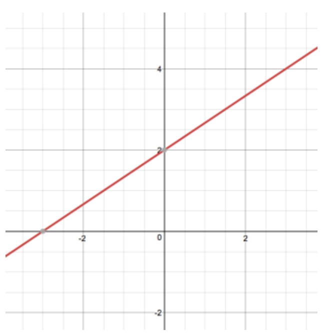

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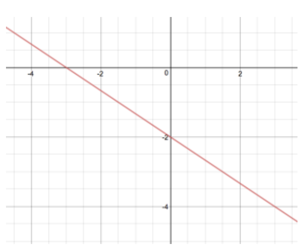
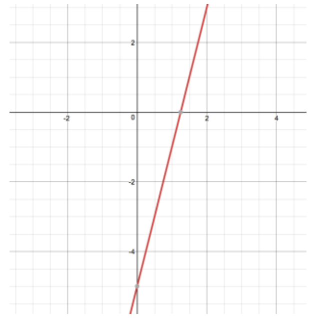


9. Graph $y = 4x - 5$.

a.



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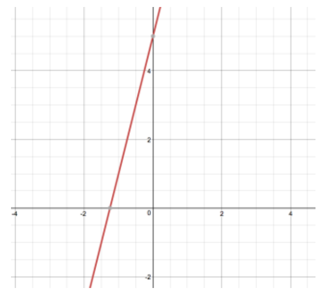

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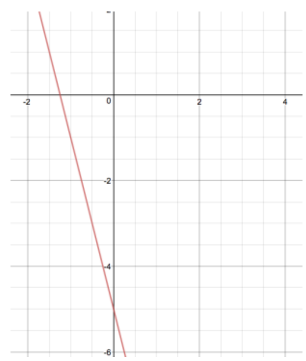

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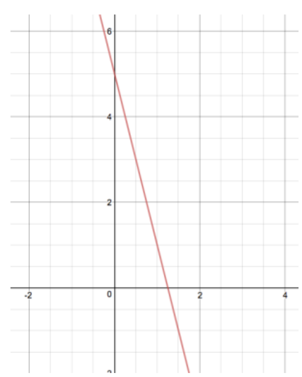

10. Find the equation of the line containing the points $(-1,-4)$ and $(-3,-8)$.

    a. $2x + y = 2$
    b. $x - 2y = 7$
    c. $2x - y = 2$
    d. $x + 2y = 7$

11. Write the equation of the line that is parallel to the graph of $12x - 4y = -2$ and passes through the point $(4,-1)$.

    a. $3x + y = -11$
    b. $x - 3y = -11$
    c. $x - 3y = 7$
    d. $3x - y = 13$

12. Write the equation of the line that is perpendicular to the graph of $x - 4y = 9$ and passes through the point $(-5,8)$.

    a. $4x + y = 12$
    b. $4x + y = -12$
    c. $x - 4y = -37$
    d. $x + 4y = 37$

13. Solve and write the solution set in set-builder notation, also graph.
    $7x - 9(x+3) \geq x + 10$

    a. $\left\{x \middle| x \geq \frac{-37}{3}\right\}$
    b. $\left\{x \middle| x \leq \frac{-37}{3}\right\}$
    c. $\left\{x \middle| x \geq \frac{-7}{3}\right\}$
    d. $\left\{x \middle| x \leq \frac{-7}{3}\right\}$

14. Simplify $\dfrac{(-2x^4y^2)^3(5x^3y)}{15x^5y^8}$

    a. $\frac{-8x^3y^7}{3y^8}$
    b. $\frac{-8x^3y}{3}$
    c. $\frac{-2x^5y^7}{3y^8}$
    d. $\frac{-8x^{10}}{3y}$
    e. $\frac{-2x^2}{3y}$

15. Multiply $(4x^2 - 6x - 5)(x^2 - x)$

    a. $4x^4 - 10x^6 + x^4 + 5x$
    b. $4x^4 - 10x^6 + x^4 + 5$
    c. $4x^4 - 10x^3 + x^2 + 5x$
    d. $4x^4 + 10x^3 + x^2 + 5x$
    e. $4x^4 - 10x^3 + x^2 + 5x$
    f. $4x^4 - 10x^6 + x^4 + 5x$
    g. $4x^4 - 10x^3 + x^2 - 5x$

16. Simplify $(3x-7)^2$

a. $9x^2 - 42x + 49$
b. $9x^2 + 49$
c. $9x^2 + 42x + 49$
d. $9x^2 - 49$
e. $9x^2 - 42x + 49$

17. Find all of the polynomial factors of the binomial $x^3 - 8$. Choose all that apply.

a. $x + 2$

b. $x^2 + 2x + 4$

c. $x^2 - 2x + 4$

d. $x^2 + 4$

e. $x^2 - 4$

f. $x - 2$

18. Find all of the polynomial factors of the trinomial $x^2 - 7x + 10$.

Choose all that apply.

a. $x - 5$
b. $x + 5$
c. $x - 2$
d. $x + 2$
e. $x + 3$
f. $x + 4$
g. $x - 3$
h. $x - 4$
i. None of the above

19. Find all of the polynomial factors of the binomial $x^2 - 16$. Choose all that apply.

a. $x - 16$
b. $x + 1$
c. $x - 2$
d. $x + 8$
e. $x + 2$
f. $x - 8$
g. $x + 4$
h. $x - 4$
i. None of the above

20. Find all of the polynomial factors of the binomial $x^2 + 25$. Choose all that apply.

a. $x - 25$
b. $x + 1$
c. $x + 25$
d. $x + 5$
e. $x + 10$
f. $x - 15$
g. $x - 1$
h. $x - 5$
i. None of the above

21. Find all of the polynomial factors of the binomial $125x^3 + 27$.
Choose all that apply.

a. $5x + 3$

b. $5x^2 + 15x + 9$

c. $5x^2 - 15x + 9$

d. $25x^2 - 15x + 9$

e. $25x^2 + 15x + 9$

f. $5x - 3$

22. Find all of the polynomial factors

of the trinomial $x^2 - 9x + 10$.

Choose all that apply.

a. $x - 9$
b. $x + 1$
c. $x - 1$
d. $x + 10$
e. $x + 9$
f. $x + 4$
g. $x - 5$
h. $x - 10$
i. None of the above

23. Find all of the polynomial factors

of the trinomial $2x^2 - x - 3$.

Choose all that apply.

a. $x - 1$
b. $x + 3$
c. $x - 3$
d. $x + 1$
e. $2x - 3$
f. $2x + 3$
g. $2x + 1$
h. $2x$
i. None of the above

24. Find all of the polynomial factors

of the trinomial $6x^3 + 14x^2 - 12x$.

Choose all that apply.

a. $x - 1$
b. $3x^2 + 7x - 6$
c. $x - 6$
d. $x + 3$
e. $6x - 1$
f. $3x - 2$
g. $2x + 1$
h. $2x$
i. $6x$
j. None of the above

25. Find all of the polynomial factors of the trinomial $6x^2 - 11x - 10$.

Choose all that apply.

a. $x - 10$
b. $3x - 2$
c. $x + 1$
d. $x + 5$
e. $6x - 1$
f. $3x + 2$
g. $2x - 5$
h. $6x$
i. None of the above

26. Add $\frac{4x}{3x-1} + \frac{9}{x+4}$

a. $\frac{4x^2 + 43x - 9}{(3x-1)(x+4)}$
b. $\frac{4x+9}{4x-3}$
c. -3
d. $\frac{4x+9}{(3x-1)(x+4)}$

27. Multiply

$$\frac{3x^2 + 26x + 16}{3x^2 - 7x - 6} \cdot \frac{x^2 + 2x - 15}{2x^2 + 9x - 5}.$$

a. $\frac{x-8}{2x-1}$
b. -8
c. $\frac{(x+8)(3x+2)}{(3x-2)(2x+1)}$
d. $\frac{(x-8)(3x-2)}{(3x+2)(2x-1)}$

28. Divide

$$\frac{x^2 + 2x - 15}{9 - x^2} \div \frac{x^2 - 7x + 6}{x^2 - 3x - 18}$$

a. $\frac{x-8}{2x-1}$
b. -8
c. $\frac{(x+8)(3x+2)}{(3x-2)(2x+1)}$
d. $\frac{(x-8)(3x-2)}{(3x+2)(2x-1)}$

$\frac{-(x+3)^2}{(x+5)(x-1)}$

e. $\frac{x+5}{-(x-1)}$
f. $\frac{x+5}{x-1}$

29. Subtract $\frac{2x}{x^2 - x - 6} - \frac{6}{x+2}$

a. $\frac{2x-6}{x^2-4}$
b. $\frac{x-3}{x^2-2}$
c. $\frac{-4x+18}{(x+2)(x-3)}$
d. $\frac{-4x-18}{(x+2)(x-3)}$

30. Solve $\frac{y}{3} + \frac{y-8}{10} = \frac{4y+7}{5}$

a. $\frac{-15}{11}$
b. -6
c. 6
d. $\frac{15}{11}$

31. Simplify $-\sqrt{\frac{8}{27}x^{13}y^{8}z}$

a. $-\frac{2}{9}xz\sqrt{6x^{6}y^{4}}$

b. $-\frac{2}{3}x^{6}y^{4}\sqrt{2xz}$

c. $x^{6}y^{4}\sqrt{\frac{8xz}{27}}$

d. $-\frac{2}{9}x^{6}y^{4}\sqrt{6xz}$

32. Simplify $\frac{\sqrt{45}}{\sqrt{63x}}$

a. $\frac{\sqrt{5}}{\sqrt{7x}}$

b. $\frac{5}{7x}$

c. $\frac{\sqrt{35}}{7}$

d. $\frac{\sqrt{35x}}{7x}$

33. Solve $(x-5)(x+1) = 7$

a. $\{12, 6\}$

b. $\{2, -6\}$

c. $\{-2, 6\}$

d. $\{-12, 6\}$

34. Solve $x^2 - 11x - 13 = 0$

a. $\left\{\frac{11 \pm \sqrt{173}}{2}\right\}$

b. $\left\{\frac{-11 \pm \sqrt{173}}{2}\right\}$

c. $\left\{\frac{11 \pm \sqrt{69}}{2}\right\}$

d. $\left\{\frac{-11 \pm \sqrt{69}}{2}\right\}$

35. Solve $(3x+4)^2 = 8$

a. $\left\{\frac{-8}{3}\right\}$

b. $\left\{\frac{-4 \pm 2\sqrt{2}}{3}\right\}$

c. $\left\{\frac{3+\sqrt{8}}{4}\right\}$

d. $\left\{\frac{-2}{3}\right\}$

Answers

1. c
2. b
3. a
4. a
5. d
6. b
7. a
8. a
9. a
10. c
11. d
12. b
13. b
14. d
15. c
16. a
17. b, f
18. a, c
19. g, h
20. i
21. a, d
22. i
23. d, e
24. d,f,h
25. f, g
26. a
27. a
28. e
29. c
30. b
31. d
32. d
33. c
34. a
35. b

Rationale

1. Substitute 4 in for a and -2 into b to get $\frac{4^2-(-2)^2}{4-(-2)}$. Following order of operations, $\frac{16-4}{4-(-2)} = \frac{12}{6} = 2$.

2. Start with the distributive property in side of the brackets to get $-7x + 3[x - 3 + 2x]$. By combining like terms in the brackets, the expression becomes $-7x + 3[3x - 3]$. Using the distributive property again gives $-7x + 9x - 9$, which simplifies to $2x - 9$.

3. Simplify the left and right hand sides using the distributive property and combining like terms. $3[2 - 4(2x - 1)] = 4x - 10$ becomes $3[2 - 8x + 4] = 4x - 10$, $3[-8x + 6] = 4x - 10$, and then$-24x + 18 = 4x - 10$. Adding $24x$ and 10 to both sides gives $28 = 28x$. Isolate the x by dividing both sides by 28, gives the solution of 1.

4. Subtraction is equivalent to adding the opposite. So, by distributing the negative to the second polynomial, we get $3x^2 + 2x - 5 - x^2 - 4x + 12$, and by combining like terms this simplifies to $2x^2 - 2x + 7$.

5. To isolate the y term, subtract $5x$ from both sides to get $-2y = -5x + 10$. Divide both sides by -2 to get $y = \frac{-5x+10}{-2}$. The -2 then divides into each term of the numerator giving $y = \frac{5}{2}x - 5$.

6. First, distribute the d to get $S = a + nd - d$, next isolate the term with the n by subtracting a from both sides and adding d to both sides to get $S - a + d = nd$. Divide both sides by d to get $n = \frac{S-a+d}{d}$.

7. Multiply both sides of the equation by t to clear the fraction resulting in $Rt = C - S$. Isolate the S, by adding S and subtracting Rt. This gives $S = C - Rt$.

8. There are several ways to graph a line. For this one, it is convenient to find the x intercept and the y intercept. To find the x intercept, substitute 0 in for y, resulting is the equation $2x = 6$. Dividing both sides by 2, gives $x = 3$. Plot the point $(3,0)$. To find the y intercept, substitute 0 in for x, resulting is the equation $3x = 6$. Dividing both sides by 3, gives $y = 2$. Plot the point $(0,2)$. Drawing the line through the two points gives the graph in a.

9. There are several ways to graph a line. For this one, it is convenient to use the slope and the y intercept. The slope is 4 and the y intercept is -5. Start at the point $(0, -5)$ and use the slope to find another point on the graph. The slope of $4 = \frac{4}{1}$ means that for every increase in 4 in the vertical direction, there is an increase in 1 in horizontal direction, resulting in the graph in a.

10. To find the equation of a line, you need a point and a slope. The slope is calculated by $m = \frac{-8+4}{-3+1} = \frac{-4}{-2} = 2$. Pick one of the points, and plug into the point-slope formula $y + 4 = 2(x + 1)$, rearranging into standard form gives $2x - y = 2$.

11. To find the equation of a line, you need a point and a slope. The line is parallel to $12x - 4y = -2$. Rearranging this line in slope-intercept form gives $y = 3x + \frac{1}{2}$. The slope of this line is 3 and parallel lines have the same slope, so the slope of the line you are asked to find, also has a slope of 3. Plugging the slope and the given point into the point-slope intercept formula gives $y + 1 = 3(x - 4)$. Rearranging into standard form gives $3x - y = 13$.

12. To find the equation of a line, you need a point and a slope. The line is perpendicular to $x - 4y = 9$. Rearranging this line in slope-intercept form gives $y = \frac{1}{4}x - \frac{9}{4}$. The slope of this line is $\frac{1}{4}$. Perpendicular lines have slopes that are opposite reciprocals of each other, so the slope of the line you are asked to find is - 4. Plugging the slope and the given point into the point-slope intercept formula gives $y - 8 = -4(x + 5)$. Rearranging into standard form gives $4x + y = -12$.

13. Start by using the distributive property to simplify the left side of the inequality and combining like terms to get $-2x - 27 \geq x + 10$. To isolate the x, subtract x and add 27 to both sides. This gives $-3x \geq 37$. To isolate the x, divide both sides by -3. Dividing by the negative changes the relationship between the sides and gives $x \leq \frac{-37}{3}$.

14. Using rules of exponents, start in the numerator $(-2x^4y^2)^3$ is $(-2)^3(x^4)^3(y^2)^3$which simplifies to $-8x^{12}y^6$. That is multiplied by $5x^3y$ giving $-40x^{15}y^7$. Next, divide $\frac{-40x^{15}y^7}{15x^5y^8}$ to get $\frac{-8x^{10}}{3y}$.

15. To multiply the polynomials, distribute every term of the first polynomial to every term of the second polynomial. Starting with multiplying the $4x^2$, to give $4x^4 - 4x^3$, then the $-6x$ multiplies to give $-6x^3 + 6x^2$, and lastly, the -5 to get $-5x^2 + 5x$. Combining the like terms and writing them in descending order gives $4x^4 - 10x^3 + x^2 + 5x$.

16. $(3x - 7)^2$ means $(3x - 7)(3x - 7)$ and multiplying the binomials gives $9x^2 - 21x - 21x + 49$. Combine like terms to get $9x^2 - 42x + 49$.

17. The formula for factoring the difference of two cubes is $a^3 - b^3$ is $(a - b)(a^2 + ab + b^2)$. Here $x^3 - 8 = x^3 - 2^3$. Replacing a with x and b with 2 gives $(x - 2)(x^2 + 2x + 4)$.

18. To factor a trinomial in the form $x^2 + bx + c$, you need numbers that multiply to *c* and add to *b*. These numbers are each added to an x to form binomial factors. For this trinomial, numbers that multiply to 10 and add to -7 are required. These numbers are -2 and -5. The trinomial factors as $(x - 2)(x - 5)$.

19. The formula for factoring the difference of two squares is $a^2 - b^2$ is $(a - b)(a + b)$. Here $x^2 - 16 = x^2 - 4^2$. Replacing *a* with *x* and *b* with 4 gives $(x - 4)(x + 4)$.

20. A polynomial in the sum of two squares form $a^2 + b^2$ is not factorable over the real numbers.

21. The formula for factoring the sum of two cubes is $a^3 + b^3$ is $(a + b)(a^2 - ab + b^2)$. Here $125x^3 + 27 = (5x)^3 + 3^3$. Replacing *a* with 5*x* and *b* with 3 gives $(5x + 3)(25x^2 - 15x + 9)$.

22. To factor a trinomial in the form $x^2 + bx + c$, you need numbers that multiply to *c* and add to *b*. These numbers are each added to an *x* to form binomial factors. For this trinomial, numbers that multiply to 10 and add to - 9 are required. No such numbers exist and therefore the trinomial not factorable.

23. To factor a trinomial in the form $ax^2 + bx + c$, you need numbers that multiply to $a \cdot c$ and add to b. These numbers can be used to guide your guess in the "trial and error" method of factoring or they can be used in the splitting and grouping technique: $a \cdot c = -6$, numbers that multiply to -6 and add to -1 are -3 and 2, rewrite the polynomial as $2x^2 - 3x + 2x - 3$, and use the 2-2 grouping method to get $x(2x - 3) + 1(2x - 3)$, which then gives $(2x - 3)(x + 1)$.

24. First, factor out the greatest common factor, $2x$, to give $2x(3x^2 + 7x - 6)$. To factor a trinomial in the form $ax^2 + bx + c$, you need numbers that multiply to $a \cdot c$ and add to b. These numbers can be used to guide your guess in the "trial and error" method of factoring or they can be used in the splitting and grouping technique: $a \cdot c = -18$, numbers that multiply to - 18 and add to 7 are 9 and - 2, rewrite the trinomial as $3 + 9x - 2x - 6$, and use the 2-2 grouping method to get $3x(x + 3) - 2(x + 3)$, which then gives $(x + 3)(3x - 2)$. The final factored for is $2x(x + 3)(3x - 2)$

25. To factor a trinomial in the form $ax^2 + bx + c$, you need numbers that multiply to $a \cdot c$ and add to b. These numbers can be used to guide your guess in the "trial and error" method of factoring or they can be used in the splitting and grouping technique: $a \cdot c = -60$, numbers that multiply to - 60 and add to - 11 are - 15 and 4, rewrite the polynomial as $6x^2 - 15x + 4x - 10$, and use the 2-2 grouping method to get $3x(2x - 5) + 2(2x - 5)$, which then gives $(2x - 5)(3x + 2)$.

26. This is the addition of two fractions, so a common denominator is needed. In this case, the common denominator is $(3x-1)(x+4)$ (found by multiplying the two denominators together since there is no common factor between them). Next, build up each fraction to this common denominator.

$$\frac{4x}{3x-1} = \frac{4x(x+4)}{(3x-1)(x+4)} = \frac{4x^2+16x}{(3x-1)(x+4)}$$

$$\frac{9}{x+4} = \frac{9(3x-1)}{(x+4)(3x-1)} = \frac{27x-9}{(3x-1)(x+4)}$$

Add the two fractions together and combine like terms.

This gives $\frac{4x^2+43x-9}{(3x-1)(x+4)}$. Remember NOT to add the denominators.

27. Factor the polynomials in the numerators and the denominators. Multiply the fractions straight across. Cancel out any common factors to simplify.

$$\frac{3x^2+26x+16}{3x^2-7x-6} \times \frac{x^2+2x-15}{2x^2+9x-5} =$$

$$\frac{(x+8)(3x+2)}{(x-3)(3x+2)} \cdot \frac{(x+5)(x-3)}{(2x-1)(x+5)} = \frac{x+8}{2x-1}$$

28. Change the operation from division to multiplication and take the reciprocal or "flip" the second fraction (Note: do NOT flip the first fraction). Factor the polynomials in the numerators and denominators. Multiply the fractions straight across. Cancel out any common factors to simplify.

$$\frac{x^2+2x-15}{9-x^2} \div \frac{x^2-7x+6}{x^2-3x-18} = \frac{x^2+2x-15}{-x^2+9} \div \frac{x^2-7x+6}{x^2-3x-18} = \frac{x^2+2x-15}{-(x^2-9)} \cdot \frac{x^2-3x-18}{x^2-7x+6}$$

$$= \frac{(x+5)(x-3)}{-(x+3)(x-3)} \cdot \frac{(x-6)(x+3)}{(x-6)(x-1)} = \frac{x+5}{-(x-1)}$$

29. This is the subtraction of two fractions, so a common denominator is needed. The common denominator is $x^2-x-6=(x-3)(x+2)$ (found by factoring the two denominators and noting the common factor between them). Next, build up each fraction to this common denominator.

$$\frac{2x}{x^2-x-6}=\frac{2x}{(x-3)(x+2)}$$

$$\frac{6}{x+2}=\frac{6(x-3)}{(x+2)(x-3)}=\frac{6x-18}{(x+2)(x-3)}$$

Now subtract the two fractions. Remember to distribute the negative sign and combine like terms.

$$\frac{2x}{(x-3)(x+2)}-\frac{6x-18}{(x+2)(x-3)}=\frac{2x-6x+18}{(x+2)(x-3)}=\frac{-4x+18}{(x+2)(x-3)}$$

30. Begin by clearing the fractions by multiplying both sides of the equation by the least common multiple, in this case 30. Distribute the LCM (30), on the left hand side of the equation. This results in $10y+3(y-8)=6(4y+7)$. Simplify both the left hand side and right hand side of the equation. $13y-24=24y+42$. Then solve to give $y=-6$.

31. For the coefficients, find the largest perfect square that is a factor. That square root will appear outside the radical. The other factor will remain on the inside. You will then have to rationalize the denominator by multiplying the top and bottom of the fraction by $\sqrt{3}$. For the variables, use the "short cut" for taking square roots of variables. Divide the exponent of each of the variables by 2. The quotient will be the exponent on the outside and the remainder will be the exponent on the inside. Since the exponent on *z* is smaller than 2, *z* will remain on the inside of the radical.

32. Both 45 and 63 are both divisible by 9. So $\frac{\sqrt{45}}{\sqrt{63x}}=\frac{\sqrt{5}}{\sqrt{7x}}$. From here, rationalize the denominator by multiplying the top and bottom of the fraction by the $\sqrt{7x}$, giving $\frac{\sqrt{45}}{\sqrt{63x}}=\frac{\sqrt{5}}{\sqrt{7x}}\cdot\frac{\sqrt{7x}}{\sqrt{7x}}=\frac{\sqrt{35x}}{7x}$.

33. Begin by multiplying the two binomials on the left hand side using "FOIL." Then subtract the 7 to the left hand side. This will put the equation in standard form $x^2-4x-12=0$. This quadratic equation is able to be factored into $(x-6)(x+2)=0$. Then, using the zero product property, spilt the equation into $x-6=0$ and $x+2=0$. Solve for each for *x*.

34. Upon examination, this quadratic equation is not factorable, therefore, use the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$. Substituting in gives $=\frac{-(-11)\pm\sqrt{(-11)^2-4(1)(-13)}}{2(1)}$ which simplifies to $x=\frac{11\pm\sqrt{173}}{2}$. Note that the value of b is negative, so when substituting into the quadratic formula x there is a double negative.

35. Begin by taking the square root of both sides (a technique called extraction of roots). Whenever a square root is introduced to an equation, you need to account for both the positive and negative root (hence the ±). You will then subtract the 4 from both sides, and lastly, divide both sides by 3 to give an answer of $\left\{\frac{-4\pm2\sqrt{2}}{3}\right\}$.