1. An expression is shown below:

   $2\sqrt{21x}$

   Which value of x makes the expression equivalent to $12\sqrt{21}$?

   $2\sqrt{21x}$ $12\sqrt{21}$ $2\cdot6\sqrt{21}$ $2\sqrt{36}\sqrt{21}$

   36

2. An expression is shown below:

   $7\sqrt{35x}$

   Which value of x makes the expression equivalent to $14\sqrt{35}$?

   $7\cdot2\sqrt{35}$ $7\sqrt{4}\sqrt{35}$

   4

3. An expression is shown below:

   $6\sqrt{57x}$

   Which value of x makes the expression equivalent to $42\sqrt{57}$?

   $6\cdot7\sqrt{57}$ $6\cdot\sqrt{49}\cdot\sqrt{57}$

   49

4. An expression is shown below:

   $12\sqrt{82x}$

   Which value of x makes the expression equivalent to $36\sqrt{82}$?

   $12\cdot3\sqrt{82}$ $12\cdot\sqrt{9}\cdot\sqrt{82}$

   9

5. Simplify: $3(2\sqrt{9})^{-3}$ $3(2(3))^{-3} = 3(6)^{-3} = \frac{3}{6^3} = \frac{3}{216} = \frac{1}{72}$

6. Simplify: $4(2\sqrt{16})^2$ $4(2(4))^2 = 4(8)^2 = 4(64) = 256$

7. Simplify: $\frac{10^2(2\sqrt{25})^{-1}}{2}$ $= \frac{10^2(2(5))^{-1}}{2} = \frac{10^2(10)^{-1}}{2} = \frac{100}{2(10)^1} = \frac{100}{20} = 5$

8. Simplify: $\frac{27(2\sqrt{9})^{-3}}{3}$ $= \frac{27(2(3))^{-3}}{3} = \frac{27(6)^{-3}}{3} = \frac{27}{3(6)^3} = \frac{27}{3(216)} = \frac{27}{648} = \frac{1}{24}$

9. A polynomial expression is shown below.

   $(mx^3 + 2)(3x^2 + 2x + 5) - (24x^5 + 40x^3)$

   The expression is simplified to $16x^4 + 6x^2 + 4x + 10$. What is the value of m?

   $m = 8$, See next page

10. A polynomial expression is shown below.

    $(mx^3 + 3)(x^2 + 3x + 4) - (2x^5 + 8x^3 + 9x)$

    The expression is simplified to $6x^4 + 3x^2 + 12$. What is the value of m?

    $m = 2$, see next page

11. A polynomial expression is shown below.

    $(mx^3 + 4)(4x^2 + x + 2) - (3x^4 + 6x^3 + 16x^2)$

    The expression is simplified to $12x^5 + 4x + 8$. What is the value of m?

    $m = 3$, See next page

9. $(mx^3+2)(3x^2+2x+5) - (24x^5+40x^3)$

$3mx^5+2mx^4+5mx^3+6x^2+4x+10-24x^5-40x^3$

$3mx^5-24x^5+2mx^4+5mx^3-40x^3+6x^2+4x+10$

$=0$ $\quad 2\cdot\_=16$ $\quad =0$ $\quad \downarrow \quad \downarrow \quad \downarrow$

Answer $\quad 16x^4 \quad +6x^2 \quad +4x \quad +10$

$\boxed{m=8}$

10, $(mx^3+3)(x^2+3x+4) - (2x^5+8x^3+9x)$

$mx^5+3mx^4+4mx^3+3x^2+9x+12-2x^5-8x^3-9x$

$mx^5-2x^5+3mx^4+4mx^3-8x^3+3x^2+\cancel{9x}-\cancel{9x}+12$

$0 \quad 3\cdot\_=6 \quad 0$

Answer $\quad 6x^4 \quad +3x^2 \quad +12$

$\boxed{m=2}$

11, $(mx^3+4)(4x^2+x+2) - (3x^4+6x^3+16x^2)$

$4mx^5+mx^4+2mx^3+16x^2+4x+8-3x^4-6x^3-16x^2$

$4mx^5+mx^4-3x^4+2mx^3-6x^3+\cancel{16x^2}-\cancel{16x^2}+4x+8$

$4\cdot\_=12$ $\quad \downarrow \quad \downarrow$

Answer $12x^5 \quad +4x \quad +8$

$m=3$

12. $(mx^3+5)(x^2+x+5) - (6x^4+5x^2+25)$

$mx^5+mx^4+5mx^3+5x^2+5x+25-6x^4-5x^2-25$

$mx^5+mx^4-6x^4+5mx^3+\cancel{5x^2}-\cancel{5x^2}+5x+\cancel{25}-\cancel{25}$

$5\cdot\_=30$ $\quad \downarrow$

Answer: $6x^5 \quad +30x^3 \quad +5x$

$\boxed{m=6}$

12. A polynomial expression is shown below.

$(mx^3 + 5)(x^2 + x + 5) - (6x^4 + 5x^2 + 25)$

The expression is simplified to $6x^5 + 30x^3 + 5x$. What is the value of m?

m=6, see previous page

13. Factor the trinomial $x^2 - x - 12$? Factors(-12) Add(-1) -4, 3

$(x-4)(x+3)$

14. Factor the trinomial $x^2 - 6x + 5$?

$(x-5)(x-1)$

15. Factor the trinomial $x^2 + x - 6$?

$(x+3)(x-2)$

16. Factor the trinomial $x^2 + 11x + 30$?

$(x+6)(x+5)$

17. Simplify:

$$\frac{x^2 + 8x + 15}{x^2 + 7a + 10}; x \neq -5, -2 \qquad \frac{(x+3)(x+5)}{(x+2)(x+5)} = \boxed{\frac{x+3}{x+2}}$$

18. Simplify:

$$\frac{x^2 - 5x - 36}{x^2 + 8x + 16}; x \neq -4 \qquad \frac{(x-9)(x+4)}{(x+4)(x+4)} = \boxed{\frac{x-9}{x+4}}$$

19. Simplify:

$$\frac{x^2 - 9x + 14}{3x^2 - 12}; x \neq 2, -2 \qquad \frac{(x-7)(x-2)}{3(x^2-4)} = \frac{(x-7)(x-2)}{3(x+2)(x-2)} = \boxed{\frac{x-7}{3(x+2)}}$$

20. Simplify:

$$\frac{2x^3 + 8x^2}{5x^2 + 20x}; x \neq -4, 0 \qquad \frac{2x^2(x+4)}{5x(x+4)} = \frac{2x^2}{5x} = \boxed{\frac{2x}{5}}$$

21. Anna burned 25 calories per minute running for x minutes and 5 calories per minute hiking for y minutes. She spent a total of 50 minutes running and hiking and burned 450 calories. The system of equations shown below can be used to determine how much time Anna spent on each exercise.

$25x + 5y = 450$

$-5(x + y = 50) \Rightarrow -5x - 5y = -250$

$20x = 200$

$\frac{20x}{20} = \frac{200}{20}$

$x = 10$

What is the value of x, the minutes Anna spent running?

Anna spent 10 minutes running

22. A shipment of computer monitors, some weighing 25lb and the other weighing 40lb each, has a total weight of 680lb. If there are 20 monitors altogether, how many weigh 40lb (y)?

$25x + 40y = 680$
$-25(x + y = 20) \Rightarrow$ $25x + 40y = 680$, $-25x - 25y = -500$

$15y = 180$, $\frac{15y}{15} = \frac{180}{15}$

$y = 12$

23. A group of students goes out to lunch. If two have burritos and five have tacos, the bill will be $19.50. If five have burritos and 2 have tacos, the bill will be $22.50. Find the price of the burrito, x.

$-2(2x + 5y = 19.50)$
$5(5x + 2y = 22.50) \Rightarrow$ $-4x - 10y = -39$, $25x + 10y = 112.5$

$21x = 73.5$, $\frac{21x}{21} = \frac{73.5}{21}$

$x = 3.50$

24. A geometry teacher has a set of 60 plastic pentagons and octagons. She happened to notice that all the figures together have a total of 354 sides. How many pentagons, x, does the teacher have?

$5x + 8y = 354$
$-8(x + y = 60)$ $5x + 8y = 354$, $-8x - 8y = -480$

$-3x = -126$, $\frac{-3x}{-3} = \frac{-126}{-3}$

$x = 42$

25. Samantha and Maria purchased flowers. Samantha purchased 5 roses for x dollars each and 4 daisies for y dollars each and spent $41 on the flowers. Maria purchased 1 rose for x dollars each and 6 daisies for y dollars each and spent $29. The system of equations shown below represents this situation.

$5x + 4y = 41$
$-5(x + 6y = 29)$ $5x + 4y = 41$, $-5x - 30y = -145$

$-26y = -104$

$y = 4$ daisies

$x + 6y = 29$
$x + 6(4) = 29$
$x + 24 = 29$
$-24 \quad -24$
$x = 5$

How much did each rose cost?

26. A baseball team had $1,500 to spend on supplies. The team spent $285 on a new bat. New baseballs cost $6 each. The inequality $285 + 6b \leq 1{,}500$ can be used to determine the number of new baseballs (b) that the team can purchase. What is the maximum number of baseballs that can be purchased?

$b \leq 202.5$ maximum # of baseballs is 202

27. Canyu Canoe Co. rents canoes for $8 plus $3 per hour or any part of an hour. For how many hours can you rent a canoe if you want to spend no more than $25? Use the inequality $3x + 8 \leq 25$ to determine the answer.

$x \leq 5.\overline{6}$ 5 hours

28. Suppose you are a salesperson for Glitz 'n Glitter. Each month you earn $450 plus one-eighth of your sales. What amount must you sell this month to earn more than $2000? Use the inequality $450 + \frac{1}{8}x > 2000$ to find the answer.

26. $285 + 6b \leq 1500$
$-285 \quad -285$
$\frac{6b}{6} \leq \frac{1215}{6}$
$b \leq 202.5$

27. $3x + 8 \leq 25$
$-8 \quad -8$
$\frac{3x}{3} \leq \frac{17}{3}$
$x \leq 5.\overline{6}$

28. $450 + \frac{1}{8}x > 2000$
$-450 \quad -450$
$\frac{1}{8}x > 1550 \cdot 8$
$x > 12{,}400$
must sell at least 12,400

29. Tyreke always leaves a tip of between 6% and 15% for the server when he pays for his dinner. This can be represented by the system of inequalities shown below, where y is the amount of tip and x is the cost of dinner.

    $y > 0.06x$
    $y < 0.15x$

    $y > 0.06x$ $\quad y < 0.15x$
    $y > 0.06(35)$ $\quad y < 0.15(35)$
    $y > 2.1$ $\quad y < 5.25$ x

    What is the minimum and maximum tip Tyreke will leave if his bill is $35?

    min: $2.10 max: $5.25

30. Tyreke always leaves a tip of between 15% and 25% for the server when he pays for his dinner. This can be represented by the system of inequalities shown below, where y is the amount of tip and x is the cost of dinner.

    $y > 0.15x$
    $y < 0.25x$

    $y > 0.15x$ $\quad y < 0.25x$
    $y > 0.15(50)$ $\quad y < 0.25(50)$
    $y > 7.5$ $\quad y < 12.5$

    What is the minimum and maximum tip Tyreke will leave if his bill is $50?

    min: $7.50 max: $12.50

31. Tyreke always leaves a tip of between 10% and 20% for the server when he pays for his dinner. This can be represented by the system of inequalities shown below, where y is the amount of tip and x is the cost of dinner.

    $y > 0.1x$
    $y < 0.2x$

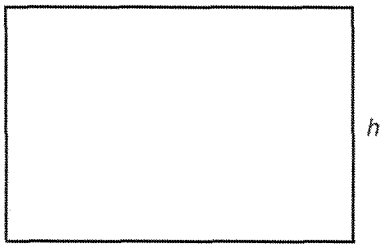
    Would $5.50 be an acceptable tip if his bill was $45?

    $y > 0.1x$ $\quad y < 0.2x$
    $y > 0.1(45)$ $\quad y < 0.2(45)$
    $y > \$4.50$ $\quad y < \$9$

    tip should be between $4.50 and $9.00.
    yes, $5.50 is an acceptable tip.

Algebra 1 Keystone Open-ended questions

1. Keng creates a painting on a rectangular canvas with a width that is ~~four~~ six inches longer than the height, as shown in the diagram below.



A. Write a polynomial expression, in simplified form, that represents the area of the canvas.

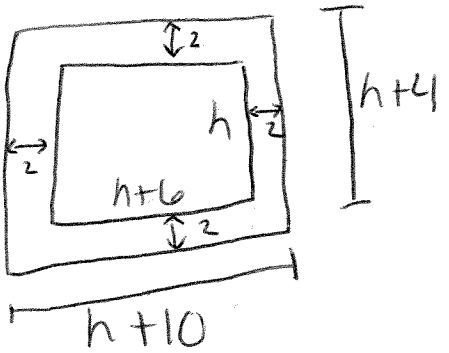
$A = \ell w$

$h(h+6)$

h^2+6h inches^2

Keng adds a 2-inch-wide frame around all sides of his canvas.

B. Write a polynomial expression, in simplified form, that represents the total area of the canvas and the frame.



$A = \ell w$

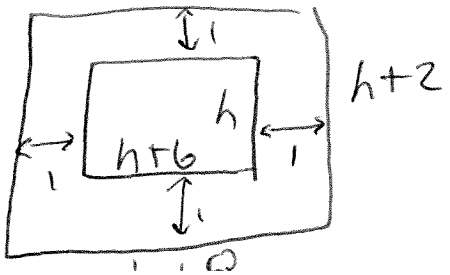
$(h+4)(h+6)$

$h^2+6h+4h+24$

$h^2+10h+24$ inches^2

Keng is unhappy with his 2-inch-wide frame, so he decides to put a frame with a different width around his canvas. The total area of the canvas and the new frame is given by the polynomial $h^2 + 10h + 16$, where h represents the height of the canvas.

C. Determine the width of the new frame. Show all your work. Explain why you did each step.

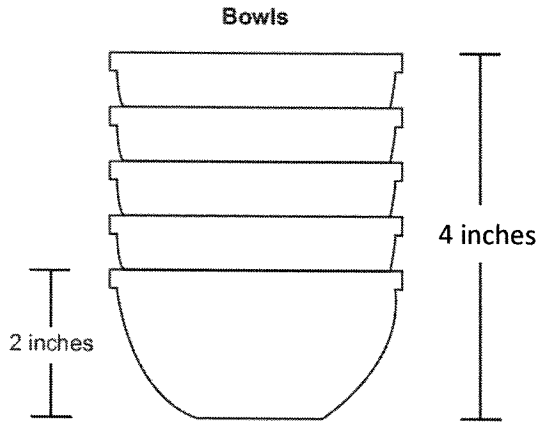


$h^2+10h+16$

$(h+8)(h+2)$

1 inch

2. The diagram below shows 5 identical bowls stacked one inside the other.



The height of 1 bowl is 2 inches. The height of a stack of 5 bowls is 4 inches.

A. Write an equation using x and y to find the height of a stack of bowls based on any number of bowls.

$(1, 2)$ $(5, 4)$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-2}{5-1} = \frac{2}{4} = \frac{1}{2}$

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

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

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

$+2 \qquad +2$

$\boxed{y = \frac{1}{2}x + 1\frac{1}{2}}$

B. Describe what the x and y variable represent.

x = # bowls

y = height of the bowls

C. What is the height, in inches, of a stack of 10 bowls?

$y = \frac{1}{2}x + 1\frac{1}{2}$

$y = \frac{1}{2}(10) + 1\frac{1}{2}$

$y = 5 + 1\frac{1}{2}$

$\boxed{y = 6\frac{1}{2} \text{ inches}}$