MA 109 — College Algebra
EXAM 2 - REVIEW

Spring 2011 **Name:** ______________________ **Sec.:** ________

1. Approximate the solution to $8x^3 + 12x^2 + 6x + 1 = 5$.

   Possibilities:

   (a) $x \approx 0.1713$

   (b) $x \approx -0.0770$

   (c) $x \approx 0.1775$

   (d) $x \approx 0.3550$

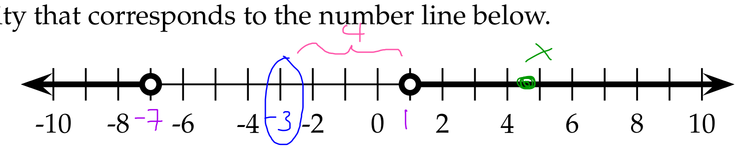
   (e) $x \approx 5.0000$

enter as $y_1 = (x/(x+11)) + 1$

2. Suppose you want to graph $(y-1)(x+11) = x$ on your graphing calculator. What should you enter into your calculator?

   $y - 1 = \dfrac{x}{x+11}$ 1st Divide by $x+11$, 2nd add 1 $y = \dfrac{x}{x+11} + 1$

3. Find the inequality that corresponds to the number line below.



   Possibilities:

   (a) $|x+3| < 4$

   (b) $|x-3| > 4$

   (c) $|x+3| > 4$

   (d) $|x-4| > 3$

   (e) $|x-4| < 3$

midpoint $= \dfrac{-7+1}{2} = \dfrac{-6}{2} = -3$

Distance from -3 to $1 = |-3-1| = |-4| = 4$

So the distance from x to -3 is greater than 4

$\underbrace{|x-(-3)|}$ $\underbrace{>}$ 4

Consequently, we have $|x+3| > 4$

4. Solve the inequality $x^2 - x - 39 \geq -9$. Write the solution set in interval notation.

   Possibilities:

   (a) $(-\infty, -9]$

   (b) $[-9, \infty)$

   (c) $(-\infty, -6] \cup [5, \infty)$

   (d) $[-5, 6]$

   (e) $(-\infty, -5] \cup [6, \infty)$

$x^2 - x - 39 \geq -9$ Add 9 (same)

$x^2 - x - 39 + 9 \geq -9 + 9$ Simplify (same)

$x^2 - x - 30 \geq 0$ Factor (same)

$(x-6)(x+5) \geq 0$ want +

Critical Numbers $(x-6)(x+5) = 0$

$x - 6 = 0$, $x = 6$ $x + 5 = 0$, $x = -5$

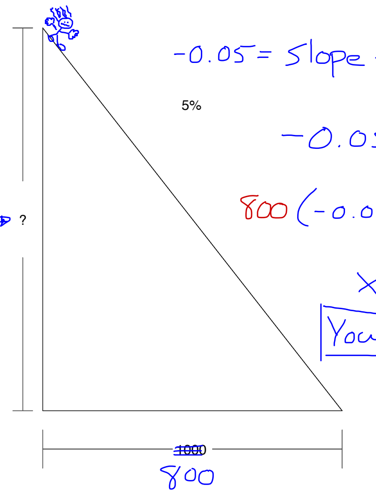
-6 0 7
-5 6

Test Point	$x-6$	$x+5$	sign
-6	−	−	+
0	−	+	−
7	+	+	+

Answer: $(-\infty, -5] \cup [6, \infty)$

5. When you are traveling in the mountains, you will often see signs about the grade of the road. If you are traveling downhill and you see a sign indicating that the road has a 7 percent grade, then the slope of the road is $\frac{-7}{100}$. Suppose you are traveling downhill on a road with a 5 percent grade. If your horizontal distance has changed by 800 feet, how far have you descended?

Call this "x"



$-0.05 = \text{slope} = \frac{\text{rise}}{\text{run}} = \frac{x}{800}$

$-0.05 = \frac{x}{800}$ Multiply by 800

$800(-0.05) = \left(\frac{x}{\cancel{800}}\right)\cancel{800}$ Simplify

$x = -40$ feet (descend)

$\boxed{\text{You will descend 40 feet}}$

Possibilities:

(a) $\boxed{\text{40 feet}}$

(b) 140 feet

(c) 190 feet

(d) -10 feet

(e) 90 feet

6. Suppose you want to graph $4x - 2y + 14 = 0$ on your graphing calculator. What should you enter into your calculator?

$4x - 2y + 14 = 0$ Subtract $4x$

$4x - 2y + 14 - 4x = 0 - 4x$ Simplify

$-2y + 14 = -4x$ Subtract 14

$-2y + 14 - 14 = -4x - 14$ Simplify

$-2y = -4x - 14$ Divide by -2

$\frac{\cancel{-2}y}{\cancel{-2}} = \frac{-4x-14}{-2}$ Simplify

$y = \frac{-4x-14}{-2}$

Enter into your calculator $y_1 = (-4*x-14)/(-2)$

7. How many solutions does the following system of equations have?

$$\begin{cases} 6x + 27y = 36 \xrightarrow{\text{Divide by 3}} 2x + 9y = 12 \\ -4x + 18y = 24 \xrightarrow{\text{Divide by 2}} -2x + 9y = 12 \end{cases}$$

$$\frac{18y}{18} = \frac{24}{18}$$

Substitute into either equation $\quad y = \frac{24}{18} = \frac{12}{9} = \frac{4}{3}$

Possibilities:

I chose Equation 1 But you can use either

$6x + 27 \cdot \frac{4}{3} = 36$ Simplify

$6x + 36 = 36$ Subtract 36

$6x + 36 - 36 = 36 - 36$ Simplify

$6x = 0$ Divide by 6

$\frac{6x}{6} = \frac{0}{6}$ Simplify

$x = 0$

(a) No solutions

$\boxed{\text{(b) One solution}}$ ← $(0, \frac{4}{3})$

(c) Two solutions

(d) Three solutions

(e) Infinitely many solutions

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8. Let $f(x) = 2x^2 + 6x$. Find $\dfrac{f(x+h) - f(x)}{h}$.

Possibilities: 1st Compute $f(x+h) = 2(x+h)^2 + 6(x+h) = 2(x+h)(x+h) + 6(x+h)$

$= 2(x^2 + xh + hx + h^2) + 6x + 6h = 2(x^2 + 2xh + h^2) + 6x + 6h$

$= 2x^2 + 4xh + 2h^2 + 6x + 6h$

(a) $2h^2 + 6h$

(b) $-4x - 2h - 6$

(c) $\dfrac{2h^2 + 6h}{h}$

$\boxed{\text{(d) } 4x + 2h + 6}$

(e) $\dfrac{4xh + 2h^2 + 12x + 6h}{h}$

$$\frac{f(x+h) - f(x)}{h} = \frac{(2x^2 + 4xh + 2h^2 + 6x + 6h) - (2x^2 + 6x)}{h}$$

$$= \frac{\cancel{2x^2} + 4xh + 2h^2 \cancel{+6x} + 6h \cancel{-2x^2} \cancel{-6x}}{h}$$

$$= \frac{4xh + 2h^2 + 6h}{h} = \frac{\cancel{h}(4x + 2h + 6)}{\cancel{h}} = \boxed{4x + 2h + 6}$$

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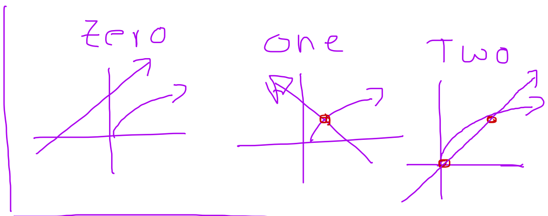
9. Suppose you need to solve a system of equations in which one equation is $y = \sqrt{x}$ and the other equation represents a line. How many solutions could your system have? Zero, one, or two



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10. Solve the inequality.

$$\frac{x+8}{x-7} \geq 0$$

Possibilities: Critical Numbers:

$x + 8 = 0 \quad$ or $\quad x - 7 = 0$

$x = -8 \qquad x = 7$

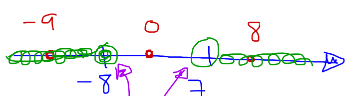
(a) $[-8, 7)$

(b) $(-\infty, -8) \cup (7, \infty)$

$\boxed{\text{(c) } (-\infty, -8] \cup (7, \infty)}$

(d) $(-8, 7)$

(e) $[-8, 7]$



Test Point	$x+8$	$x-7$	sign
-9	$-$	$-$	$+$
0	$+$	$-$	$-$
8	$+$	$+$	$+$

Note: include -8 because that makes the numerator (so the fraction equal to zero), and exclude 7 because 7 is not in the domain of the expression $\frac{x+8}{x-7}$.

Answer: $(-\infty, -8] \cup (7, \infty)$

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11. Solve the inequality.

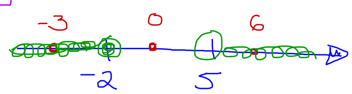
$$\frac{x+2}{x-5} \geq 0$$

Critical Numbers:

$x+2=0$ or $x-5=0$

$x=-2$ $\quad$ $x=5$

Test Point	$x+2$	$x-5$	sign
-3	$-$	$-$	$+$
0	$+$	$-$	$-$
6	$+$	$+$	$+$



Possibilities:

(a) $(-\infty, -2] \cup (5, \infty)$

(b) $[-2, 5)$

(c) $(-\infty, -2) \cup (5, \infty)$

(d) $(-2, 5)$

(e) $[-2, 5]$

Answer: $(-\infty, -2] \cup (5, \infty)$

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12. Carol has \$4000. She invests x dollars at a simple interest rate of 6% and the rest of her money at a simple interest rate of 5%. After one year, the total interest earned on these investments is \$215.00. Which of the equations below would you solve to find x?

Possibilities:

(a) $0.06x \times 0.05(4000 - x) = 215.00$

(b) $6x + 5(4000 - x) = 215.00$

(c) $\dfrac{x}{6} + \dfrac{4000 - x}{5} = 215.00$

(d) $0.06x + 0.05(4000 - x) = 215.00$

(e) $\dfrac{x}{0.06} + \dfrac{4000 - x}{0.05} = 215.00$

x = amount invested at 6%

y = amount invested at 5%

Total Amount of money: $x + y = 4000$

solve for y: $y = 4000 - x$

Calculate Interest:

Interest on 6% account = amount * percent = $x * 0.06 = 0.06x$

Interest on 5% account = amount * percent = $y * 0.05 = 0.05y$

Total interest earned = 215.00

$0.06x + 0.05y = 215$ substitute

$0.06x + 0.05(4000 - x) = 215$

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13. Solve the inequality.

$$(x+4)(x-2) \geq 0$$

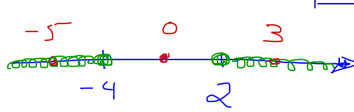
Critical Numbers:

$(x+4)(x-2)=0$

$x+4=0$ or $x-2=0$

$x=-4$ $\quad$ $x=2$

Test Point	$x+4$	$x-2$	sign
-5	$-$	$-$	$+$
0	$+$	$-$	$-$
3	$+$	$+$	$+$



Possibilities:

(a) $[-4, 2]$

(b) $(-4, 2)$

(c) $(-\infty, -4) \cup (2, \infty)$

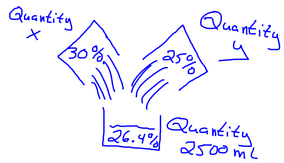
(d) $(-\infty, \infty)$

(e) $(-\infty, -4] \cup [2, \infty)$

Answer: $(-\infty, -4] \cup [2, \infty)$

14. What quantity, x, of a 30% acid solution must be mixed with a 25% acid solution to produce 2500 mL of a 26.4% solution?

Possibilities:



Total Amount: $x + y = 2500$ → Multiply by -0.25 → $-0.25x - 0.25y = -625$

Acid Amount: $0.30x + 0.25y = 660$ → $0.30x + 0.25y = 660$

Elimination Method

$0.05x + 0y = 35$

$\frac{0.05x}{0.05} = \frac{35}{0.05}$

$\boxed{x = 700 \text{ mL}}$

(a) 500 mL

(b) 900 mL

(c) 700 mL

(d) 600 mL

(e) 800 mL

Amount of Acid:

Acid from the 30% acid solution = amount * percent = $x * 0.30 = 0.30x$

Acid from the 25% acid solution = amount * percent = $y * 0.25 = 0.25y$

Acid from the 26.4% acid solution = amount * percent = $2500 * 0.264 = 660$

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15. Solve the inequality.

$$\frac{x+5}{x-6} \geq 0$$

Critical Numbers:

$x + 5 = 0$ or $x - 6 = 0$

$x = -5$ $\quad$ $x = 6$

Test Point	$x+5$	$x-6$	sign
-6	$-$	$-$	$+$
0	$+$	$-$	$-$
7	$+$	$+$	$+$

Possibilities:

(a) $(-\infty, -5] \cup (6, \infty)$

(b) $(-\infty, -5) \cup (6, \infty)$

(c) $[-5, 6)$

(d) $[-5, 6]$

(e) $(-5, 6)$

-6 $\quad$ 0 $\quad$ 7

-5 $\quad$ 6

Answer: $(-\infty, -5] \cup (6, \infty)$

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16. Solve the inequality and graph the solution set on the real number line.

$$15 - 2x \geq 11$$

$15 - 2x - 15 \geq 11 - 15$ Subtract 15 (Same)

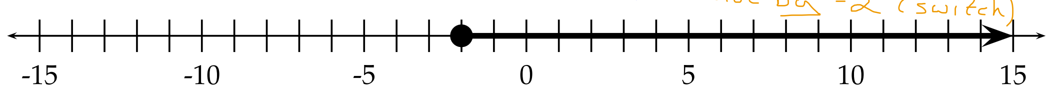
$-2x \geq -4$ Simplify (same)

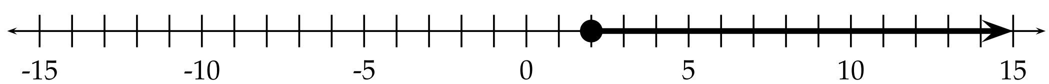
$\frac{\cancel{-2}x}{\cancel{-2}} \leq \frac{-4}{-2}$ Divide by -2 (switch)

Simplify (same)

$\boxed{x \leq 2}$

Possibilities:

(a)


(b)


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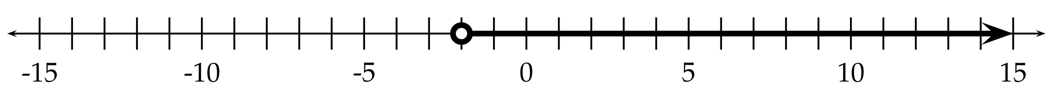
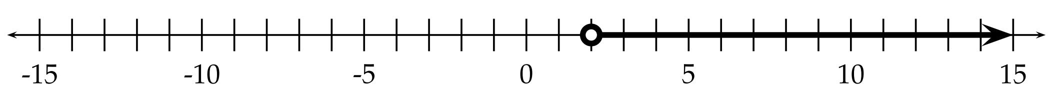


(d)


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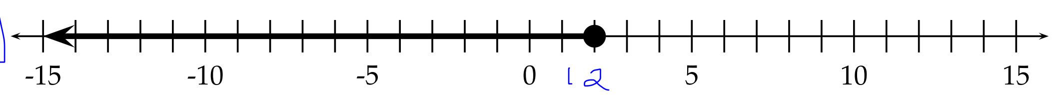


17.

$$f(x) = \begin{cases} x+2 & \text{if } x \le 3 \\ x-2 & \text{if } x > 3 \end{cases}$$

Find $f(5)$.

Possibilities:

(a) $\frac{7}{3}$

(b) Both 7 and 3.

(c) 21

(d) 7

$\boxed{\text{(e) } 3}$

Step 1: Determine which expression to use

Is $5 \le 3$? No!!! so don't use $x+2$

Is $5 > 3$? Yes ☺ so use $x-2$

Therefore, $f(5) = 5 - 2 = 3$

18. Let $f(x) = \sqrt{8-x}$. Find the domain of $f(x)$.

Possibilities:

(a) $(-8, \infty)$

(b) $(-\infty, 8)$

$\boxed{\text{(c) } (-\infty, 8]}$

(d) $(-\infty, -8) \cup (8, \infty)$

(e) $[8, \infty)$

Must have $8 - x \ge 0$

$8 - x + x \ge 0 + x$ Add x (same)

$8 \ge x$ Simplify (same)

$(-\infty, 8]$

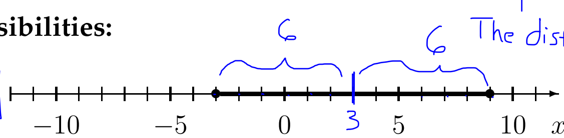
19. Suppose you need to solve a system of equations in which one equation is $y = |x|$ and the other equation represents a line. How many solutions could your system have? zero, one, two, or infinite

20. Solve the inequality and graph the solution set on the real number line.

$$|x - 3| \le 6$$

The distance from x to 3 is less than or equal to 6

Possibilities:

$\boxed{\text{(a)}}$


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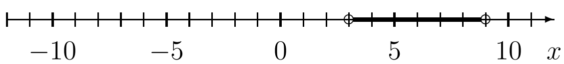

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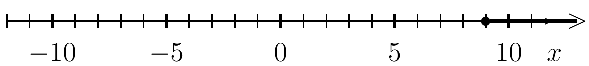

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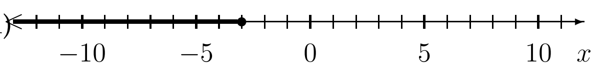

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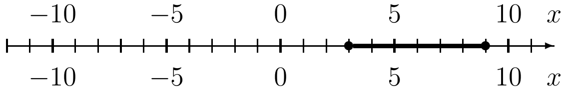
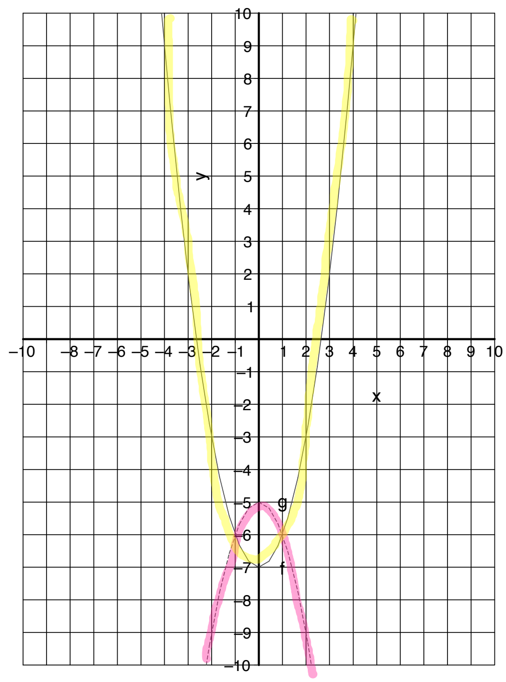


21. In the graph below, the solid graph is the graph of $y = f(x)$ and the dashed graph is the graph of $y = g(x)$. Which of the following statements are true?



(I) $f(0) < g(0)$ $= -7$, $= -5$

(II) $f(1) = g(1)$ $= -6$, $= -6$

(III) $f(2) > g(2)$ $= -3$, $= -9$

Possibilities:

(a) **(I)**, **(II)**, and **(III)** are all true.

(b) Only **(I)** is true.

(c) None of the statements are true.

(d) Only **(II)** is true.

(e) Only **(I)** and **(III)** are true.

22. Find all the solutions of the system of equations.

See work on Next Page

$$\begin{cases} -3x + y = 4 \\ x^2 - 10x - y = -44 \end{cases}$$

Two Solutions (8,28) and (5,19)

23. Let $f(x) = |x - 4|$. Evaluate $f(7 - 9)$. $= f(-2) = |-2-4| = |-6| = \boxed{6}$

$\boxed{\#22}$

$-3x + y = 4$ Solve for y $\longrightarrow$ $y = 4 + 3x$

$x^2 - 10x - y = -44$

Substitution Method

Substitute into Equation 2

$x^2 - 10x - (4 + 3x) = -44$ Distribute

$x^2 - 10x - 4 - 3x = -44$ Simplify

$x^2 - 13x - 4 = -44$ Add 44

$x^2 - 13x - 4 + 44 = -44 + 44$ Simplify

$x^2 - 13x + 40 = 0$ Factor

$x^2 - 5x - 8x + 40 = 0$

$x(x-5) - 8(x-5) = 0$

$(x-8)(x-5) = 0$ Zero Product Rule

$x - 8 = 0$ & $x - 5 = 0$

$x = 8$ $\quad$ $x = 5$

Back Substitute to find y

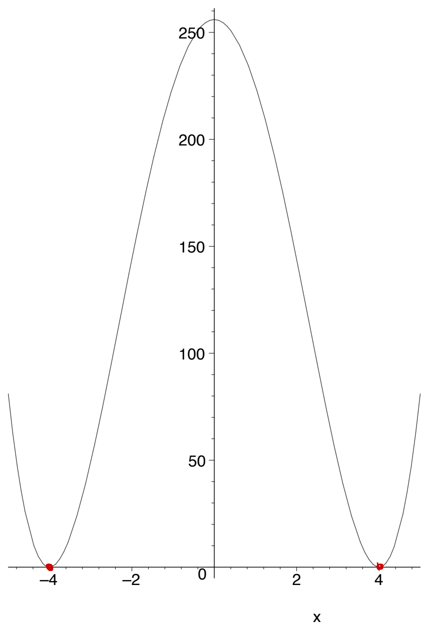
$y = 4 + 3(8)$ $\quad$ $y = 4 + 3(5)$

$y = 4 + 24$ $\quad$ $y = 4 + 15$

$y = 28$ $\quad$ $y = 19$

$(8, 28)$ $\quad$ $(5, 19)$

24. The graph of $y = f(x)$ is shown below. Use the graph to find the solutions of $f(x) = 0$. (**HINT:** All of the solutions are integers.)



$\boxed{x = \pm 4}$

25. Solve the inequality.

$$(x+8)(x-7) < 0$$

Possibilities:

(a) $(-8, 7)$

(b) $[-8, 7]$

(c) $(-\infty, \infty)$

(d) $(-\infty, -8) \cup (7, \infty)$

(e) $(-\infty, -8] \cup [7, \infty)$

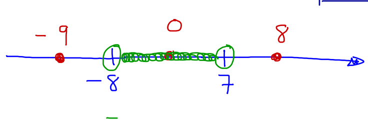
Critical Numbers:

$(x+8)(x-7) = 0$

$x+8=0$ or $x-7=0$

$x=-8$ $\quad$ $x=7$

Test Point	$x+8$	$x-7$	sign
−9	−	−	+
0	+	−	−
8	+	+	+



Answer: $(-8, 7)$

26. Let $f(x) = 4x + 7$. Find $\dfrac{f(x+h) - f(x)}{h}$.

1st Compute: $f(x+h) = 4(x+h) + 7 = 4x + 4h + 7$

Consequently, $\dfrac{f(x+h)-f(x)}{h} = \dfrac{(4x+4h+7)-(4x+7)}{h} = \dfrac{\cancel{4x}+4h\cancel{+7}-\cancel{4x}\cancel{-7}}{h} = \dfrac{4\cancel{h}}{\cancel{h}} = \boxed{4}$

27. Find the interval on the Celsius scale corresponding to a Fahrenheit temperature between 30^oF and 110^oF. Recall that the relationship between degrees Celsius (C) and degrees Fahrenheit (F) is given by the equation $F = \frac{9}{5}C + 32$. $\xrightarrow{\text{Subtract } 32}$ $F - 32 = \frac{9}{5}C$ $\quad C = \frac{5}{9}(F-32)$

Solve for C

multiply by $\frac{5}{9}$

$\frac{5}{9}[F-32] = C$

If $F = 30^o$

$C = \frac{5}{9}(30-32) = \frac{5}{9} \cdot \frac{(-2)}{1} = \frac{-10}{9} = -1.11\ldots$

If $F = 110^o$ then

$C = \frac{5}{9}(110-32) = \frac{5}{9} \cdot \frac{78}{1} = \frac{390}{9} = 43.33\ldots$

Possibilities:

$\boxed{\text{(a)}}$ The temperature is between about $\boxed{-1.11^oC}$ and $\boxed{43.33^oC.}$

(b) The temperature is between about -3.60^oC and 140.40^oC.

(c) The temperature is between about 60.40^oC and 204.40^oC.

(d) The temperature is between about 111.60^oC and 255.60^oC.

(e) The temperature is between about 86.00^oC and 230.00^oC.

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28. A ball is thrown straight upward at an initial speed of 96 ft/sec. From Physics it is known that, after t seconds, the ball reaches a height h feet given by the formula

$$h = -16t^2 + 96t.$$

When does the ball hit the ground?

Possibilities: Height is zero when ball hits the ground

$0 = -16t^2 + 96t$

$0 = -16t\,[t-6]$

$\frac{-16t}{-16} = \frac{0}{-16}$ & $t - 6 = 0$, $\ +6 \ +6$

$t = 0$ second $\quad t = 6$ second

Consequently, the ball is at ground level when time is at zero second (initial) and six seconds.

(a) 3.00 sec

(b) 144.00 sec

$\boxed{\text{(c) 6.00 sec}}$

(d) 196.30 sec

(e) 4.30 sec

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29. Kayla earns \$8.50 per hour. If she works more than 40 hours in a week, she is paid time and a half (1.5 times her regular salary) for every hour over 40 hours. Her gross pay last week was \$403.75. How many hours did Kayla work last week?

Note $40 \times 8.5 = 340$. Since Kayla made 403.75 last week she must have worked more than 40 hours.

Kayla is payed time and a half for over time $= 1.5 \times 8.5 = 12.75$

Note of the \$403.75, $403.75 - 340 = \$63.75$ is over time pay.

Therefore, Kayla worked $\frac{63.75}{12.75} = 5$ hours of over time last week.

Consequently Kayla worked $40 + 5 = 45$ hours last week.

30. How many solutions does the following system of equation have?

$$\begin{cases} x = -1 \\ x^2 + y^2 = 4 \end{cases}$$

vertical line at $x=-1$

Circle centered at the origin of radius 2

Possibilities:

(a) No solutions

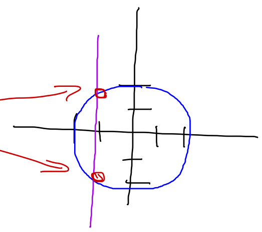
(b) One solution

$\boxed{\text{(c) Two solutions}}$

(d) Three solutions

(e) Infinitely many solutions

Two solutions



31. How many solutions does the following system of equation have?

$$\begin{cases} x = -2 \\ x^2 + y^2 = 4 \end{cases}$$

Vertical line at $x=-2$

Circle centered at the origin of radius 2

Possibilities:

(a) No solutions

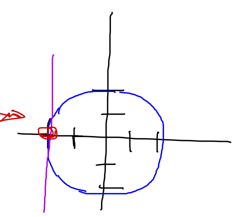
$\boxed{\text{(b) One solution}}$

(c) Two solutions

(d) Three solutions

(e) Infinitely many solutions

One Solution



32. A chemist has two large containers of hydrochloric acid (HCl) solution. The concentration of the acid is different in the two containers. She blends 100 mL of the first solution with 300 mL of the second solution to obtain a solution that is 10.2500% acid. She blends 300 mL of the first solution with 200 mL of the second solution to obtain a solution that is 12.0000% acid. What are the concentrations of hydrochloric acid in the original containers? 14% & 9%

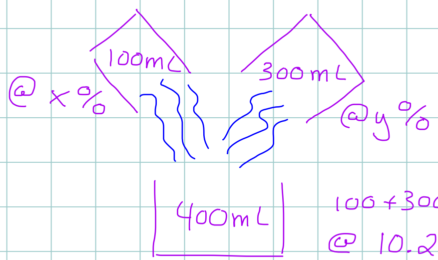
See work on Next Page

33. Let $f(x) = 3x^2 + 2x + 1$. Find $\dfrac{f(x+h) - f(x)}{h} = 3x + 3h + 2$

See work on follow page

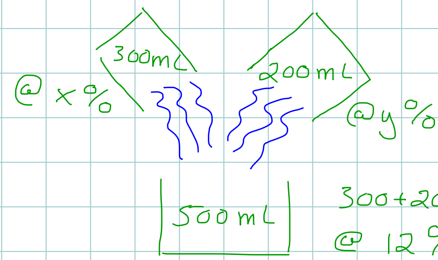
$\boxed{\#32}$ Let $x\%$ be the concentration of acid in the first container
Let $y\%$ be the concentration of acid in the second container

Event One



100 + 300 = 400 mL
@ 10.25 %

Event Two



300 + 200 = 500 mL
@ 12 %

Counting Acid we have the equation

$$100x + 300y = 0.1025(400)$$
$$100x + 300y = 41$$

Counting Acid we have the equation

$$300x + 200y = 0.12(500)$$
$$300x + 200y = 60$$

Therefore we need to solve the system $\begin{cases} 100x + 300y = 41 \\ 300x + 200y = 60 \end{cases}$

$$100x + 300y = 41 \xrightarrow{\text{Multiply by } -3} -300x - 900y = -123$$
$$300x + 200y = 60 \qquad 300x + 200y = 60$$

Elimination Method

$$\frac{-700y}{\cancel{-700}} = \frac{-63}{-700} \quad \text{Divide by } -700$$

$$y = \frac{63}{700} = 0.09$$

Now back substitute into equation 1

$$100x + 300(0.09) = 41$$
$$100x + 27 = 41 \quad \text{Subtract 27}$$
$$100x + 27 - 27 = 41 - 27 \quad \text{Simplify}$$
$$100x = 14 \quad \text{Divide by 100}$$
$$\frac{100x}{\cancel{100}} = \frac{14}{100} \quad \text{Simplify}$$
$$x = 0.14$$

Conclusion: The first container's concentration of acid is 14%
while the second container's concentration of acid is 9%

$\boxed{\#33}$

1^{st} Compute $f(x+h) = 3(x+h)^2 + 2(x+h) + 1$

$$= 3(x+h)(x+h) + 2x + 2h + 1$$

$$= 3(x^2 + xh + hx + h^2) + 2x + 2h + 1$$

$$= 3(x^2 + 2xh + h^2) + 2x + 2h + 1$$

$$= 3x^2 + 6xh + 3h^2 + 2x + 2h + 1$$

Consequently, $\dfrac{f(x+h) - f(x)}{h} = \dfrac{(3x^2 + 6xh + 3h^2 + 2x + 2h + 1) - (3x^2 + 2x + 1)}{h}$

$$= \frac{\cancel{3x^2} + 6xh + 3h^2 \cancel{+ 2x} + 2h \cancel{+ 1} \cancel{- 3x^2} \cancel{- 2x} \cancel{- 1}}{h}$$

$$= \frac{6xh + 3h^2 + 2h}{h} = \frac{\cancel{h}(6x + 3h + 2)}{\cancel{h}}$$

$$= \boxed{6x + 3h + 2}$$

34. Let $f(x) = 3 + 6x - x^2$. Find $f(u + v)$.

Possibilities:

(a) $\boxed{3 + 6u + 6v - u^2 - 2uv - v^2}$

(b) $6 + 6u + 6v - u^2 - 2uv - v^2$

(c) $6 + 6u - u^2 + 6v - v^2$

(d) $(3 + 6x - x^2)(u + v)$

(e) $3 + 6u - u^2 + 6v - v^2$

$$f(u+v) = 3 + 6(u+v) - (u+v)^2$$
$$= 3 + 6u + 6v - (u+v)(u+v)$$
$$= 3 + 6u + 6v - (u^2 + uv + vu + v^2)$$
$$= 3 + 6u + 6v - (u^2 + 2uv + v^2)$$
$$= 3 + 6u + 6v - u^2 - 2u - v^2$$

35. Let $f(x) = \sqrt{x - 2}$. Find $f(a + b)$.

$$f(a+b) = \sqrt{(a+b) - 2} = \sqrt{a + b - 2}$$

36. Let $f(x) = \dfrac{1}{\sqrt{x - 3}}$. Find the domain of $f(x)$.

Possibilities:

(a) $(-3, \infty)$

(b) $\boxed{(3, \infty)}$

(c) $(-\infty, 3]$

(d) $(-\infty, -3)$

(e) $[3, \infty)$

Need $\sqrt{x-3} \neq 0$ and $x - 3 \geq 0$ Add 3 (same)

Note $\sqrt{x-3} = 0$ means

$0^2 = x - 3$ Simplify

$0 = x - 3$ Add 3

$0 + 3 = x - 3 + 3$ Simplify

$3 = x$

or $x = 3$

in other words we can not have $x = 3$

$x - 3 + 3 \geq 0 + 3$ Simplify

$x \geq 3$

so $x > 3$

3

$(3, \infty)$

37. Joe the plumber charges a \$70 service fee plus \$50 per hour. If the total bill was \$220, how many hours did Ed work?

Possibilities:

(a) 6 hours

(b) 4 hours

(c) $\boxed{\text{3 hours}}$

(d) 5 hours

(e) 7 hours

Let x be the number of hours Joe worked

Then, Joe's Bill = Service fee + 50 * number of hours Joe worked

that is Joe's Bill = $70 + 50x$

Therefore $220 = 70 + 50x$ Subtract 70

$220 - 70 = 70 + 50x - 70$ Simplify

$150 = 50x$ Divide by 50

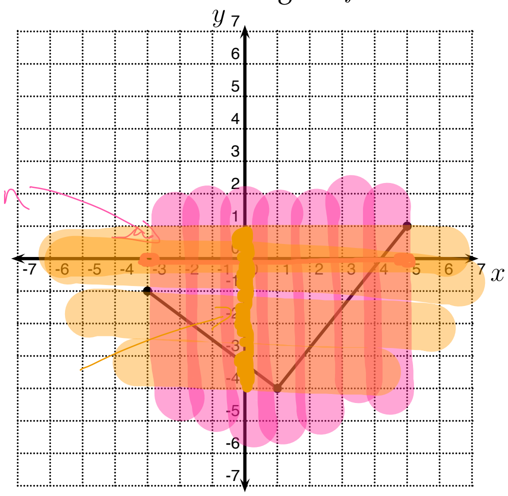
$\frac{150}{50} = \frac{\cancel{50}x}{\cancel{50}}$ Simplify

$3 = x$ or $\boxed{x = 3 \text{ hours}}$

38. The graph of $y = f(x)$ is shown below. Find the domain and range of f.

Domain $[-3, 5]$

Range $[-4, 1]$



Possibilities:

(a) Domain: $[-1, 1]$
Range: $[-3, 5]$

(b) Domain: $[-4, 1]$
Range: $[-3, 5]$

(c) Domain: $[-3, 5]$
Range: $[-4, 1]$

(d) Domain: $[-3, 5]$
Range: $[-1, 1]$

(e) Domain: $[-3, 1]$
Range: $[-4, -1]$

---

39. Let

Check this first with $x = -7$

$$f(x) = \begin{cases} |x+1| & \text{if } x \le -2 \\ x - 6 & \text{if } x > -2 \end{cases}$$

Note: $-7 \le -2$ so use the first equation

$x = -7$

Find $f(-7)$.

$f(-7) = |-7+1| = |-6| = \boxed{6}$

---

40. Let $f(x) = \dfrac{x+1}{\sqrt{x+6}}$. Find $f(2)$.

$\sqrt{8} = \sqrt{4 \cdot 2} = \sqrt{4} \cdot \sqrt{2} = 2\sqrt{2}$

$f(2) = \dfrac{2+1}{\sqrt{2+6}} = \dfrac{3}{\sqrt{8}} = \boxed{\dfrac{3}{2\sqrt{2}}}$

41. What quantity, x, of a 55% acid solution must be mixed with a 20% acid solution to produce 800 mL of a 41.875% solution?

Solution amounts: $x + y = 800$

Acid amounts: $.55x + .20y = 0.41875 \times 800$

multiply by -0.20

Elimination Method

Possibilities:

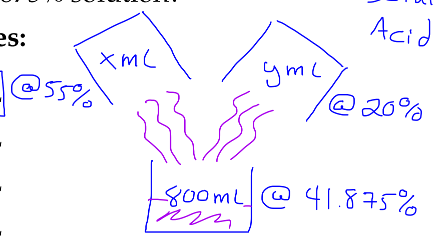
(a) $\boxed{\text{500 mL}}$

(b) 700 mL

(c) 200 mL

(d) 600 mL

(e) 300 mL



$$-0.20x - 0.20y = -160$$
$$0.55x + 0.20y = 335 \quad \text{Simplify}$$
$$0.35x + 0y = 175$$

$0.35x = 175$ Divide by 0.35

$\frac{\cancel{0.35}x}{\cancel{0.35}} = \frac{175}{0.35}$ Simplify

$\boxed{x = 500 \text{ mL}}$

42. Find four consecutive integers whose sum is 266.

65, 66, 67 and 68 See work on Next page

43. Find all the solutions of the system of equations.

$$\begin{cases} x - 5y = 10 \\ -x + y^2 - 4y = -28 \end{cases}$$

Solutions: (40, 6) and (25, 3)

See work on next Page

44. Find all the solutions of the system of equations, or state that there are no solutions.

$$\begin{cases} 7x + 6y = 6 \\ 8x + 6y = 3 \end{cases}$$

Solution: $\left(-3, \frac{27}{6}\right)$

?

45. A corner lot has dimensions 30 yards by 20 yards. The city plans to take a strip of uniform width along the two sides bordering the streets to widen these roads. How wide should the strip be if the remainder of the lot has an area of 416 square yards? Let "x" be the width of the uniform strip removed from the corner lot. Note $0 \le x \le 20$

Possibilities:

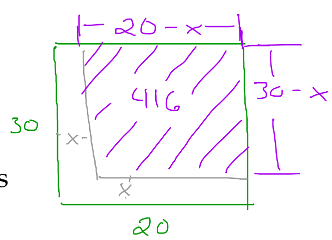
(a) 30 yards

(b) 416 yards

(c) -396 yards

(d) 415 yards

(e) 418 yards



$\boxed{\text{(f) NONE Of The Above}}$

$$(20 - x)(30 - x) = 416$$
$$600 - 20x - 30x + x^2 = 416$$
$$x^2 - 50x + 600 = 416$$
$$x^2 - 50x + 600 - 416 = 416 - 416$$
$$x^2 - 50x + 184 = 0$$
$$x^2 - 4x - 46x + 184 = 0$$
$$x(x - 4) - 46(x - 4) = 0$$
$$(x - 46)(x - 4) = 0$$

$x - 46 = 0$ or $x - 4 = 0$

$+46 \quad +46 \qquad +4 \quad +4$

$x = 46$ Impossible because $0 \le x \le 20$

$\boxed{x = 4}$

#42 Suppose x is the smallest of the four consecutive integers whose sum is 266. Then we have the equation

$$\underset{\text{first integer}}{x} + \underset{\text{second integer}}{(x+1)} + \underset{\text{third integer}}{(x+2)} + \underset{\text{fourth integer}}{(x+3)} = 266 \quad \text{Simplify}$$

$$4x + 6 = 266 \quad \text{Subtract 6}$$

$$4x + 6 - 6 = 266 - 6 \quad \text{Simplify}$$

$$4x = 260 \quad \text{Divide by 4}$$

$$\frac{\cancel{4}x}{\cancel{4}} = \frac{260}{4} \quad \text{Simplify}$$

$$x = 65$$

Consequently, the four numbers are: 65, 66, 67 and 68.

#43

$$x - 5y = 10 \xrightarrow[\text{Add } 5y]{\text{Solve for } x} x = 10 + 5y$$

$$-x + y^2 - 4y = -28$$

Substitution Method

Substitute into Equation 2

$$-(10+5y) + y^2 - 4y = -28 \quad \text{Distribute}$$

$$-10 - 5y + y^2 - 4y = -28 \quad \text{Simplify}$$

$$y^2 - 9y - 10 = -28 \quad \text{Add 28}$$

$$y^2 - 9y - 10 + 28 = -28 + 28 \quad \text{Simplify}$$

$$y^2 - 9y + 18 = 0 \quad \text{Factor}$$

$$y^2 - 3y - 6y + 18 = 0$$

$$y(y-3) - 6(y-3) = 0$$

$$(y-6)(y-3) = 0 \quad \text{Zero Product Rule}$$

$$y - 6 = 0 \qquad\qquad y - 3 = 0$$

$$+6 \;\; +6 \qquad\qquad +3 \;\; +3$$

$$y = 6 \qquad\qquad y = 3$$

Now Back Substitute to solve for x →

$$x = 10 + 5(6) \qquad\qquad x = 10 + 5(3)$$

$$x = 10 + 30 \qquad\qquad x = 10 + 15$$

$$x = 40 \qquad\qquad x = 25$$

$$\boxed{(40, 6) \quad \& \quad (25, 3)}$$

#44

$$7x + 6y = 6 \xrightarrow{\text{multiply by } -1} -7x - 6y = -6$$

$$8x + 6y = 3 \longrightarrow \underline{8x + 6y = 3}$$

Elimination Method

$$x + 0y = -3$$

$$x = -3$$

Now back substitute to solve for y. (Either equation works)

Equation One →

$$7(-3) + 6y = 6 \quad \text{Simplify}$$

$$-21 + 6y = 6 \quad \text{Add 21}$$

$$-21 + 6y + 21 = 6 + 21 \quad \text{Simplify}$$

$$6y = 27 \quad \text{Divide by 6}$$

$$\frac{\cancel{6}y}{\cancel{6}} = \frac{27}{6} \quad \text{Simplify}$$

$$y = \frac{27}{6}$$

Solution is $\left(-3, \frac{27}{6}\right)$

46. Which of the following windows is an appropriate viewing window for $y = 18x - 3x^2$?

Possibilities:

(a) $-5 \leq x \leq 25, 0 \leq y \leq 20$

(b) $-10 \leq x \leq 10, -50 \leq y \leq 50$

(c) $-10 \leq x \leq 10, -10 \leq y \leq 10$

(d) $-30 \leq x \leq 15, -100 \leq y \leq 250$

(e) None of the above windows gives a complete graph.

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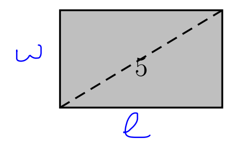
47. A rectangle has an area of 30 square feet and a **diagonal** of 5 feet. Which system of equations would you solve to find the length l and width w of the rectangle?



Possibilities:

(a) $\begin{cases} lw = 30 \\ 2l^2 + 2w^2 = 25 \end{cases}$

(b) $\begin{cases} 2l + 2w = 30 \\ l^2 + w^2 = 25 \end{cases}$

Area: $lw = 30$

Pythagorean Theorem: $l^2 + w^2 = 5^2$

(c) $\begin{cases} lw = 30 \\ 2l + 2w = 5 \end{cases}$

(d) $\begin{cases} lw = 30 \\ l^2 + w^2 = 25 \end{cases}$

(e) $\begin{cases} 2lw = 30 \\ l + w = 5 \end{cases}$

---

48. Let

$$f(x) = \begin{cases} 8 & \text{if } x \leq -5 \\ 16 & \text{if } -5 < x < -1 \\ 24 & \text{if } x \geq -1 \end{cases}$$

Find $f(-4) + f(0)$. 1st Note: $-5 < -4 < -1$ so for $x = -4$ we use the second equation 16

Possibilities:

(a) 32

(b) 16

2nd Note: $0 \geq -1$ so for $x = 0$ we use the third equation 24

(c) 24

(d) 8

(e) 40

Therefore, $f(-4) + f(0) = 16 + 24 = 40$

49. Approximate the solution to $\frac{1}{\sqrt{x^2+1}} = \frac{1}{x+5}$.

Possibilities:

(a) $x \approx -1.2062$

(b) $x \approx -2.4000$

(c) $x \approx -2.8320$

(d) $x \approx -1.2000$

$\boxed{\text{(e) } x \approx 0.3846}$

50. Find all the solutions of the system of equations, or state that there are no solutions.

$$\begin{cases} 4x - 5y = -2 \xrightarrow{\text{multiply by } -1} \\ 5x - 5y = 5 \longrightarrow \end{cases}$$

Elimination Method

$-4x + 5y = 2$

$5x - 5y = 5$

$x + 0y = 7$

$x = 7$

Back substitute into either equation to solve for y

Equation 1: $4(7) - 5y = -2$ Simplify

$28 - 5y = -2$ Subtract 28

$28 - 5y - 28 = -2 - 28$ Simplify

$-5y = -30$ Divide by -5

$\frac{\cancel{-5}y}{\cancel{-5}} = \frac{-30}{-5}$

$y = 6$

Possibilities:

(a) $x = -17/20, y = -3/5$

$\boxed{\text{(b) } x = 7, y = 6}$

(c) $x = 4, y = -5$

(d) $x = 1, y = -1$

(e) $x = -2, y = 5$