Name KEY

1: Exponent Rules

Simplify the following

1. $(-2^2)^3$

-64

2. $-\left(\frac{2}{5}\right)^{-2}$

$\frac{-25}{4}$

3. $(3x^2y)^{-3}$

$\frac{1}{27x^6y^3}$

4. $\frac{y^{-4}}{5x^{-2}}$

$\frac{x^2}{5y^4}$

5. $\frac{x^{-1}y}{xy^{-2}}$

$\frac{y^3}{x^2}$

6. $\frac{3xy^9}{2y^{-2}} \cdot \frac{-7y}{42x^5}$

$-\frac{y^{12}}{4x^4}$

2: Fractional Exponents

Evaluate the following without a calculator

1. $8^{\frac{2}{3}}$

4

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

$\frac{1}{2}$

3. $\left(\sqrt[4]{16}\right)^2$

4

4. $\sqrt[3]{1000^2}$

100

5. $\left(\sqrt[3]{-27}\right)^{-4}$

$\frac{1}{81}$

6. $-(25^{-\frac{3}{2}})$

$-\frac{1}{125}$

3: Simplifying Radicals

Simplify and rationalize the following.

1. $\sqrt{80}$

$4\sqrt{5}$

2. $\sqrt[4]{32}$

$2\sqrt[4]{2}$

3. $\sqrt[3]{54x^3}$

$3x\sqrt[3]{2}$

4. $\frac{3}{\sqrt{8}}$ $\frac{\sqrt{8}}{\sqrt{8}}$

$\frac{3\sqrt{8}}{8}$

$\frac{6\sqrt{2}}{8} = \frac{3\sqrt{2}}{4}$

5. $\sqrt{\frac{4}{75}}$

$\frac{2}{5\sqrt{3}}$ $\frac{\sqrt{3}}{\sqrt{3}}$

$\frac{2\sqrt{3}}{15}$

6. $4\sqrt{3} \cdot \sqrt{21}$

$4\sqrt{63}$

$12\sqrt{7}$

4: Factoring by GCF

Factor the following completely

1. $3x^4 - 9x^2$

$3x^2(x^2-3)$

2. $49xy + 28x - 14y$

$7(7xy+4x-2y)$

3. $18x^3y^5 - 12x^4y^2$

$6x^3y^2(3y^3-2x)$

5: Factoring Quadratic Expressions

Factor the following completely

1. $x^2 - 3x + 2$

$(x-2)(x-1)$

2. $x^2 + 5x - 6$

$(x+6)(x-1)$

3. $2x^2 + 5x - 3$

-6, -6, -1, 5, 1

$(2x-1)(x+3)$

4. $3x^2 - 8x + 4$

12, -6, -2, -8

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

5. $3x^2 + 17x + 10$

30, 15, 2, 17

$(3x+2)(x+5)$

6. $10x^2 - 19x + 6$

60, -15, -4, -19

$(5x-2)(2x-3)$

6: Special Factoring

$$a^2 + 2ab + b^2 = (a+b)^2 \qquad a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$
$$a^2 - 2ab + b^2 = (a-b)^2 \qquad a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$
$$a^2 - b^2 = (a+b)(a-b)$$

Factor the following completely

1. $4x^2 - 20x + 25$

$(2x-5)^2$

2. $49x^2 + 42xy + 9y^2$

$(7x+3y)^2$

3. $16x^4 - 81$

$(4x^2-9)(4x^2+9)$

4. $x^3 - 8$

$(x-2)(x^2+2x+4)$

5. $125x^3 + y^3$

$(5x+y)(25x^2-5xy+y^2)$

6. $64 - 27y^6$

$(4-3y^2)(16+12y^2+9y^4)$

7: Factoring through Synthetic Division

Use synthetic division to factor as indicated.

1. $x^3 - 4x^2 + 2x + 1 = (x-1)(\quad)$

$$\begin{array}{c|cccc} -1 & 1 & -4 & 2 & 1 \\ & & 1 & -3 & -1 \\ \hline & 1 & -3 & -1 & 0 \end{array}$$

$$(x-1)(x^2-3x-1)$$

2. $2x^3 + 5x + 7 = (x+1)(\quad)$

$$\begin{array}{c|cccc} -1 & 2 & 0 & 5 & 7 \\ & & -2 & 2 & -7 \\ \hline & 2 & -2 & 7 & 0 \end{array}$$

$$(x+1)(2x^2-2x+7)$$

3. $x^4 - 3x^3 + x^2 + x + 2 = (x-2)(\quad)$

$$\begin{array}{c|ccccc} 2 & 1 & -3 & 1 & 1 & 2 \\ & & 2 & -2 & -2 & -2 \\ \hline & 1 & -1 & -1 & -1 & 0 \end{array}$$

$$(x-2)(x^3-x^2-x-1)$$

4. $4x^4 + 3x^2 - 1 = (2x-1)(\quad)$

use long division for this one!

$$(2x^3+x^2+2x+1)$$

$$\begin{array}{r} 2x^3+x^2+2x+1 \\ 2x-1 \overline{)\,4x^4 \quad +3x^2 \quad -1} \\ -(4x^4-2x^3) \\ \hline 2x^3+3x^2 \\ -(2x^3-x^2) \\ \hline 4x^2 \\ -(4x^2-2x) \\ \hline 2x-1 \\ -(2x-1) \\ \hline 0 \end{array}$$

8: Solving Linear Equations

Solve the following for the unknown variable.

1. $\dfrac{2x+1}{5} = \dfrac{3x+1}{2}$

$4x+2 = 15x+5$

$-3 = 11x$

$x = \dfrac{-3}{11}$

2. $\left(\dfrac{x}{2} + \dfrac{5x}{6} = \dfrac{2x}{3} + \dfrac{1}{12}\right)12$

$6x + 10x = 8x + 1$

$16x = 8x + 1$

$8x = 1$

$x = \dfrac{1}{8}$

3. $3(x-8) + 4x = 5x - (x+7)$

$3x - 24 + 4x = 5x - x - 7$

$7x - 24 = 4x - 7$

$3x = 17$

$x = \dfrac{17}{3}$

9: Solving Quadratic Equations by Factoring

Factor to solve for x.

1. $x^2 + 5x + 6 = 0$

$(x+3)(x+2) = 0$

$x = -3 \quad x = -2$

2. $8x^2 - 6x - 5 = 0$

-40, -10, -6, 4

$(4x-5)(2x+1)$

$4x - 5 = 0 \quad 2x + 1 = 0$

$x = \dfrac{5}{4} \quad x = -\dfrac{1}{2}$

3. $11x^2 - 14x - 16 = 0$

-176, -22, 8, -14

$(11x+8)(x-2)$

$11x + 8 = 0 \quad x - 2 = 0$

$x = \dfrac{-8}{11} \quad x = 2$

10: Solving Quadratic Equations using the Quadratic Formula

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

For each equation, solve for the indicated expression.

1. $2x^2 - 4x - 1 = 0$ *for x*

$\frac{4 \pm \sqrt{16-4(2)(-1)}}{4} =$

$\frac{4 \pm \sqrt{24}}{4} = \frac{4 \pm 2\sqrt{6}}{4}$

$x = \frac{2 \pm \sqrt{6}}{2}$

2. $2x^2 + 2x + 3 = 0$ *for x*

$\frac{-2 \pm \sqrt{4-4(2)(3)}}{4} =$

$\frac{-2 \pm \sqrt{-20}}{4} = \frac{-2 \pm 2i\sqrt{5}}{4}$

$x = \frac{-1 \pm \sqrt{5}i}{2}$

3. $x^4 - 4x^2 + 2 = 0$ *for* x^2 $= u$

$u^2 - 4u + 2 = 0$

$\frac{4 \pm \sqrt{16-4(1)(2)}}{2}$

$\frac{4 \pm \sqrt{8}}{2} = \frac{4 \pm 2\sqrt{2}}{2}$

$x^2 = 2 \pm \sqrt{2}$

11: Solving Radical Equations

Solve the following for x.

1. $(\sqrt{x})^2 = (3x-1)^2$

$x = 9x^2 - 6x + 1$

$0 = 9x^2 - 7x + 1$

.589

$\frac{7 \pm \sqrt{49-4(9)(1)}}{18}$

$\frac{7 \pm \sqrt{13}}{18} = .589$ ~~.188~~

$\frac{7+\sqrt{13}}{18}$

2. $3\sqrt{2x} + 1 = 7$

$3\sqrt{2x} = 6$

$\sqrt{2x} = (2)$

$2x = 4$

$x = 2$

3. $3x^{\frac{3}{4}} - 5 = 19$

$3x^{3/4} = 24$

$(x^{3/4})^{4/3} = (8)^{4/3}$

$x = 16$

12: Solving Rational Equations

Solve the following for x

1. $\left(\frac{3}{2x} - \frac{9}{2} = 6x\right) 2x$

$3 - 9x = 12x^2$

$0 = 12x^2 + 9x - 3$

$0 = 3(4x^2 + 3x - 1)$

$3(4x-1)(x+1) = 0$

$4 \times -1 = -4$, $3 \times -1 = -3$

$x = \frac{1}{4}, -1$

2. $\left(\frac{2}{3x} + \frac{2}{3} = \frac{8}{x+6}\right) 3x(x+6)$

$2(x+6) + 2x(x+6) = 8(3x)$

$2x + 12 + 2x^2 + 12x = 24x$

$2x^2 - 10x + 12 = 0$

$2(x^2 - 5x + 6) = 0$

$-3 \times -2 = 6$, $-3 + -2 = -5$

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

$x = 3, 2$

3. $\left(\frac{2}{x+1} + \frac{x}{x-1} = \frac{2}{x^2-1}\right)(x+1)(x-1)$

$(x-1)(x+1)$

$2(x-1) + x(x+1) = 2$

$2x - 2 + x^2 + x = 2$

$x^2 + 3x - 4 = 0$

$4 \times -1 = -4$, $4 + -1 = 3$

$(x+4)(x-1)$

$x = -4, 1$

$x = -4$

13: Solving Logarithmic Equations

Solve the following for x

1. $\log_3 3^x = 7$

$3^7 = 3^x$

$x = 7$

2. $\log_9 x = \frac{1}{2}$

$9^{1/2} = x$

$x = 3$

3. $2\log_3(x+1) = 4$

$\log_3 (x+1)^2 = 4$

$3^4 = (x+1)^2$

$3^2 = \pm(x+1)$

$8 = x$ $-10 = x$

14: Function Notation

Given $f(x) = -x^2 + x$, answer the following questions.

1. Find $f(0)$

$-0^2 + 0$

$f(0) = 0$

2. ~~Find~~ Solve $f(x) = 0$

$0 = -x^2 + x$

$-x(x-1)$

$x = 0, 1$

3. Find $f\left(-\frac{1}{3}\right)$

$-\left(-\frac{1}{3}\right)^2 + \left(-\frac{1}{3}\right)$

$-\frac{1}{9} - \frac{1}{3}$

$-\frac{4}{9}$

Given $f(x) = \frac{1}{3}x + \frac{7}{4}$, answer the following questions.

4. Find the zeros of $f(x)$

$0 = \frac{1}{3}x + \frac{7}{4}$

$-\frac{7}{4} = \frac{1}{3}x$

$-\frac{21}{4} = x$

5. Solve $f(x) = \frac{1}{8}$

$\frac{1}{8} = \frac{1}{3}x + \frac{7}{4}$

$-\frac{13}{8} = \frac{1}{3}x$

$-\frac{39}{8} = x$

6. Find $f\left(-\frac{9}{8}\right)$

$\frac{1}{3}\left(-\frac{9}{8}\right) + \frac{7}{4}$

$-\frac{3}{8} + \frac{7}{4}$

$f\left(-\frac{9}{8}\right) = \frac{11}{8}$

15: Function Names

Match the following equations to their description.

C 1. $f(x) = \frac{2}{3}|4x+5| - 3$

E 2. $f(x) = \frac{2}{3}\sqrt[3]{4x+5} - 3$

G 3. $f(x) = \frac{2}{3} \cdot \frac{1}{4x+5} - 3$

H 4. $f(x) = \frac{2}{3}(4x+5)^4 - 3(4x+5)^2 - 2$

D 5. $f(x) = \frac{2}{3}(4x+5)^3 - 3$

A 6. $f(x) = \frac{2}{3}(4x+5) - 3$

B 7. $f(x) = \frac{2}{3}(4x+5)^2 - 3$

F 8. $f(x) = \frac{2}{3}\sqrt{4x+5} - 3$

A. Linear Function

~~B.~~ Quadratic Function

~~C.~~ Absolute Value Function

~~D.~~ Cubic Function

~~E.~~ Cube Root Function

~~F.~~ Square Root Function

~~G.~~ Rational Function

~~H.~~ Polynomial Function

16: Function Operations

Perform the following function operations if $f(x)=2x^2$ and $g(x)=3-4x$

1. $f(g(x))$

$2(3-4x)^2$

$2(9-24x+16x^2)$

$32x^2-48x+18$

2. $g(f(x))$

$3-4(2x^2)$

$3-8x^2$

3. $(f-g)(x)$

$2x^2-(3-4x)$

$2x^2-3+4x$

$2x^2+4x-3$

4. $f(f(x))$

$2(2x^2)^2$

$2(4x^4)$

$8x^4$

5. $g(g(x))$

$3-4(3-4x)$

$3-12+16x$

$16x-9$

6. Find $g(g(x))=0$

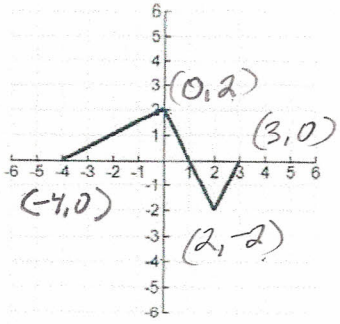
$16x-9=0$

$16x=9$

$x=\frac{9}{16}$

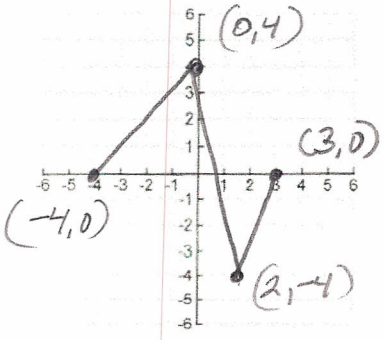
17: Function Transformation

Use the graph of $y=f(x)$ at the right to sketch the following transformations.

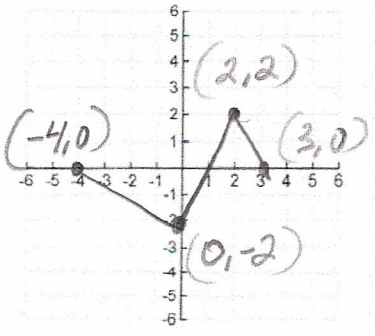


(x,y)

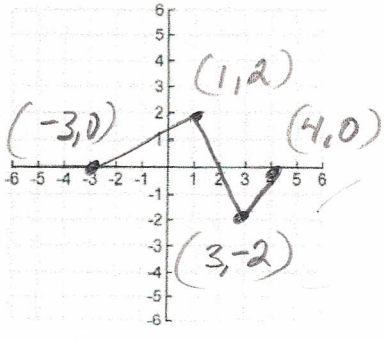
1. $y=2f(x)$ $y*2$



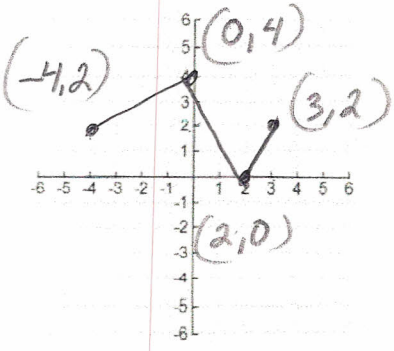
2. $y=-f(x)$ $y*-1$



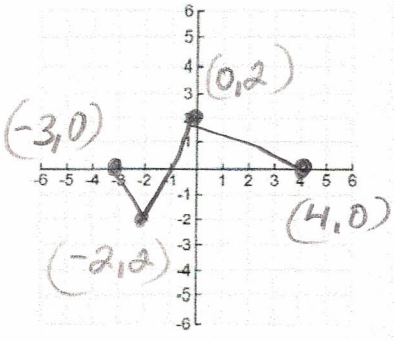
3. $y=f(x-1)$ $x+1$



4. $y=f(x)+2$ $y+2$



5. $y=f(-x)$ $x*-1$

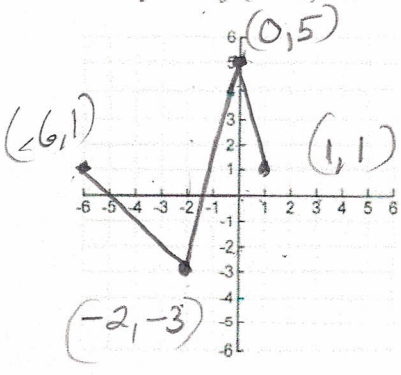


6. $y=-2f(x+2)+1$

$x-2$

$y*-2$

$+1$

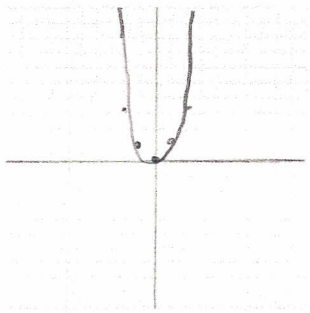


18: Graphing Parent Functions using T-Charts

Graph the following using a T-Chart with "smart" values. State the Domain and Range of each function.

1. $f(x) = x^2$

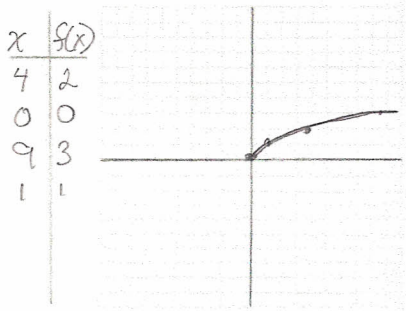
x	f(x)
-2	4
-1	1
0	0
1	1
2	4



D: $(-\infty, \infty)$ R: $[0, \infty)$

2. $f(x) = \sqrt{x}$

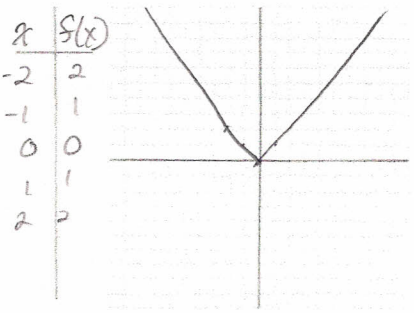
x	f(x)
4	2
0	0
9	3
1	1



D: $[0, \infty)$ R: $(0, \infty)$

3. $f(x) = |x|$

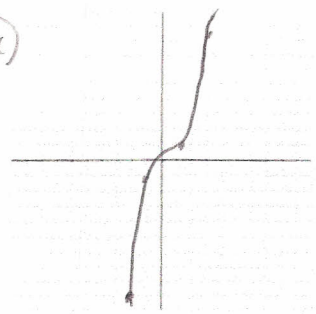
x	f(x)
-2	2
-1	1
0	0
1	1
2	2



D: $(-\infty, \infty)$ R: $[0, \infty)$

4. $f(x) = x^3$

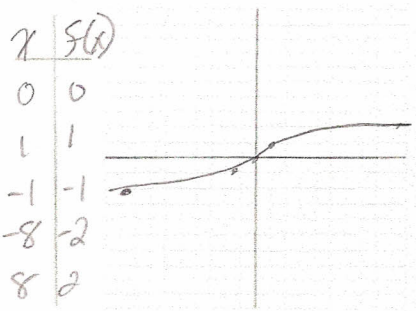
x	f(x)
-2	-8
-1	-1
0	0
1	1
2	8



D: $(-\infty, \infty)$ R: $(-\infty, \infty)$

5. $f(x) = \sqrt[3]{x}$

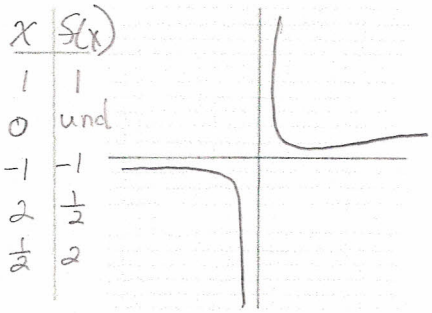
x	f(x)
0	0
1	1
-1	-1
-8	-2
8	2



D: $(-\infty, \infty)$ R: $(-\infty, \infty)$

6. $f(x) = \frac{1}{x}$

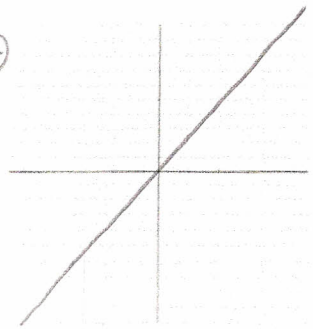
x	f(x)
1	1
0	und
-1	-1
2	$\frac{1}{2}$
$\frac{1}{2}$	2



D: $x \neq 0$ R: $x \neq 0$

7. $f(x) = x$

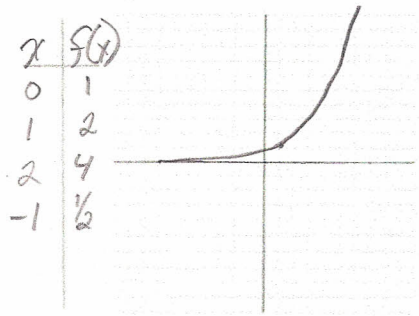
x	f(x)
-2	-2
0	0
2	2



D: $(-\infty, \infty)$ R: $(-\infty, \infty)$

8. $f(x) = 2^x$

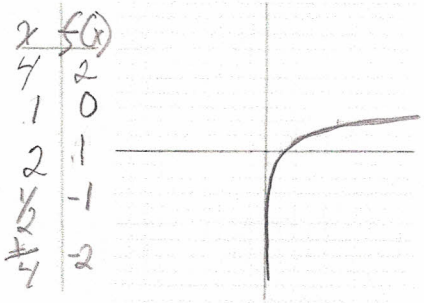
x	f(x)
0	1
1	2
2	4
-1	$\frac{1}{2}$



D: $(-\infty, \infty)$ R: $(0, \infty)$

9. $f(x) = \log_2 x$

x	f(x)
4	2
1	0
2	1
$\frac{1}{2}$	-1
$\frac{1}{4}$	-2



D: $(0, \infty)$ R: $(-\infty, \infty)$

19: Basic Graphing Choosing "Smart" Points

Fill in the T-chart using at least 3 smart x-values (that enable you to find exact points)

1. $f(x)=\sqrt{3-x}$

x	$f(x)$
3	0
-6	3
2	1
-1	2

2. $f(x)=\dfrac{7}{x-2}$

x	$f(x)$
3	7
1	-7
9	1
-5	-1

3. $f(x)=3^{\frac{x}{4}}$

x	$f(x)$
0	1
4	3
8	9

20: Distance and Midpoint Formulas

Find the distance between the two points. Then find the midpoint between the two points.

$D=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ $\quad mid=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$

1. $(-2,5);\ (6,-1)$

$D=\sqrt{(6-(-2))^2+(-1-5)^2}=\sqrt{64+36}=\sqrt{100}=10$

$m=\left(\frac{-2+6}{2},\frac{5+-1}{2}\right)=(2,2)$

2. $\left(\frac{3}{2},-\frac{1}{2}\right);\ \left(-\frac{3}{2},\frac{7}{2}\right)$

$D=\sqrt{\left(-\frac{3}{2}-\frac{3}{2}\right)^2+\left(\frac{7}{2}-\frac{-1}{2}\right)^2}$

$D=\sqrt{9+16}=5$

$m=\left(\frac{\frac{3}{2}+\frac{-3}{2}}{2},\frac{-\frac{1}{2}+\frac{7}{2}}{2}\right)=\left(0,\frac{3}{2}\right)$

3. $\left(\frac{5}{2},-\frac{3}{2}\right);\ (1,-4)$

$D=\sqrt{\left(1-\frac{5}{2}\right)^2+\left(-4-\frac{-3}{2}\right)^2}=\sqrt{\frac{9}{4}+\frac{25}{4}}=\frac{\sqrt{34}}{2}$

$m=\left(\frac{\frac{5}{2}+1}{2},\frac{-\frac{3}{2}+-4}{2}\right)=\left(\frac{7}{4},\frac{-11}{4}\right)$

21: Intercepts

Use the following equations to find the x and y intercept(s)

1. $y^2=x+9$

$0=x+9$ $\quad y^2=0+9$

$-9=x$ $\quad y^2=9$, $y=\pm 3$

$(-9,0)$ $\quad (0,3)$, $(0,-3)$

2. $9x^2+4y^2=36$

$9(0)+4y^2=36$ $\quad 9x^2+4(0)=36$

$y^2=9$ $\quad x^2=4$

$y=\pm 3$ $\quad x=\pm 2$

$(0,3)$ $(2,0)$

$(0,-3)$ $(-2,0)$

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

$\frac{x+4}{2}=1$ $\quad \left(\frac{0+4}{2}\right)+y^2=1$

$\frac{x+4}{2}=\pm 1$ $\quad 2+y^2=1$

$x+4=\pm 2$ $\quad y^2=-1$

$x=-2,-6$

$(-2,0)$ $(-6,0)$ $\quad$ NO y-int

22: Equations of Lines

Find the equation of the line that has the given characteristics. Leave your answer in the form indicated.

1. $slope=\frac{3}{4};\ y-\text{int}:-\frac{2}{3}$

$Ax+By=C$ (Standard Form)

$y=\frac{3}{4}x-\frac{2}{3}$ $\quad 12$

$12y=9x-8$

$9x-12y=8$

2. Parallel to $2x+3y=4$ through $(-3,6)$

(Slope-intercept form) $y=mx+b$

$3y=-2x+4$

$y=-\frac{2}{3}x+\frac{4}{3}$

$y=-\frac{2}{3}x+b$ $\quad (-3,6)$

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

$6=2+b$

$b=4$

$y=-\frac{2}{3}x+4$

3. Perpendicular to $4x-7y=23$ through $\left(\frac{2}{3},-\frac{4}{5}\right)$

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

$-7y=-4x+23$

$y=\frac{4}{7}x-\frac{23}{7}$

$y=-\frac{7}{4}x+b$

$y+\frac{4}{5}=-\frac{7}{4}\left(x-\frac{2}{3}\right)$