Answer Key

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1. Simplify each expression, and eliminate any negative exponent(s).

a. $(5x^{-3}y^3)(7x^2)^2 = \left(\frac{5y^3}{x^3}\right)\left(7^2\ x^{2\cdot 2}\right) = \frac{5y^3}{x^3}(49x^4)$

$= 5\cdot 49\cdot \frac{x^4}{x^3}\cdot y^3 = \boxed{245xy^3}$

Rules:

$a^n\cdot a^m = a^{n+m}$

$\frac{b^n}{b^m} = b^{n-m}$

$(c^n)^m = c^{n\cdot m}$

$d^{-n} = \frac{1}{d^{+n}}$

b. $\frac{y^{-2}z^{-3}}{y^{-1}} = \frac{y^1}{y^2\ z^3}$

$= \frac{1}{y^{2-1}z^3} = \boxed{\frac{1}{yz^3}}$

c. $\left(\frac{a^3b^{-2}}{b^3}\right)^2 = \left(\frac{a^3}{b^3\cdot b^2}\right)^2 = \left(\frac{a^3}{b^{3+2}}\right)^2 = \left(\frac{a^3}{b^5}\right)^2$

$= \frac{a^{3\cdot 2}}{b^{5\cdot 2}}$

$= \boxed{\frac{a^6}{b^{10}}}$

Rule

$\sqrt[a]{x^a} = x$

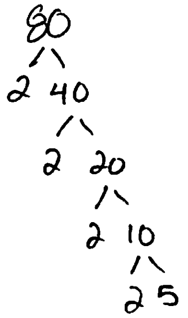
unless

$\sqrt[\text{even index}]{x^{\text{even \#}}}$

$= \left|x^{\text{odd \#}}\right|$

2. Simplify the expression. Assume that *a* and *b* denote any real numbers. (Assume that *a* denotes a positive number.)

$\sqrt[4]{80a^7b^4} = \sqrt[4]{2^4\cdot 5\,a^{4+3}\,b^4} = \sqrt[4]{2^4\cdot 5a^4a^3b^4}$



$= \sqrt[4]{2^4}\ \sqrt[4]{5}\ \sqrt[4]{a^4}\ \sqrt[4]{a^3}\ \sqrt[4]{b^4}$

$= 2\sqrt[4]{5}\cdot|a^1|\cdot\sqrt[4]{a^3}\cdot|b^1|$

$= \boxed{2|ab|\sqrt[4]{5a^3}}$

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Rule:
$a(b+c)$
$= ab+ac$

3. Find the sum, difference, or product. (Simplify your answer completely.)

$$7(x^2 - 3x + 5) - 6(x^2 - 2x + 1)$$

$$7(x^2) + 7(-3x) + 7(5) - 6(x^2) - 6(-2x) - 6(1)$$

$$\underline{7x^2} -21x + \boxed{35} - \underline{6x^2} + 12x \boxed{-6}$$

$$7x^2 - 6x^2 \quad -21x + 12x \quad + 35 - 6$$

$$\boxed{x^2 - 9x + 29}$$

4. Factor the difference of squares. Rule $A^2 - B^2 = (A+B)(A-B)$

$$49a^2 - 4$$

$$(7a)^2 - (2)^2$$

$$(7a+2)(7a-2)$$

5. Factor the trinomial. AC method : $ax^2 + bx + c$

$$7x^2 - 36x + 5$$

$$7x^2 - 35x - 1x + 5$$

$$(7x^2 - 35x) + (-1x + 5)$$

$$7x(x-5) + -1(x-5)$$

$$\boxed{(x-5)(7x-1)}$$

Find ac $= 7(5) = 35$
What factors of 35 add to -36
$-1 \quad -35$
Replace bx term with new factors and factor by grouping.

6. Factor the trinomial.

$$x^2 + 10x - 39$$

$$\boxed{(x-3)(x+13)}$$

What factors of -39 will add to 10
-39
$1 \quad 39$
$3 \quad 13 \rightarrow +3 -13 \neq 10$
$-3 + 13 = 10$

Note: Can use ac method if you choose to.

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7. Perform the multiplication or division and simplify.

$$\frac{x^2+3x+2}{x^2+9x+20}\cdot\frac{x^2+7x+10}{x^2+4x+4}$$

Factor each numerator and denominator

$$=\frac{(x+2)(x+1)}{(x+5)(x+4)}\cdot\frac{(x+2)(x+5)}{(x+2)(x+2)}$$

Remember: $\frac{a}{b}\cdot\frac{c}{d}=\frac{ac}{bd}$

and $\frac{a}{\cancel{b}}\cdot\frac{\cancel{b}}{d}=\frac{a}{d}$

$$=\frac{\cancel{(x+2)}(x+1)\cancel{(x+2)}\cancel{(x+5)}}{\cancel{(x+5)}(x+4)\cancel{(x+2)}\cancel{(x+2)}}$$

$$=\boxed{\frac{x+1}{x+4}}$$

8. Perform the addition or subtraction and simplify.

$$\frac{1}{x+6}+\frac{3}{x-1}$$

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

Rule: $\frac{a}{b}+\frac{c}{d}=\frac{ad+cb}{bd}$

1st Find LCD
rewrite each fraction with LCD
add fractions.

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

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

$$=\frac{x-1+3x+18}{(x+6)(x-1)}=\frac{x+3x-1+18}{(x+6)(x-1)}=\boxed{\frac{4x+17}{(x+6)(x-1)}}$$

9. The given equation is either linear or equivalent to a linear equation. Solve the equation.

$$7(1-x)=8(1+2x)+9$$

Distribute
combine like terms
Solve for x.

$$7-7x=8+16x+9$$

$$7-7x=17+16x$$

$$+7x \qquad +7x$$

$$7=17+23x$$

$$-17 \qquad -17$$

$$\frac{-10}{23}=\frac{23x}{23}$$

$$\frac{-10}{23}=x$$

$$\boxed{x=-10/23}$$

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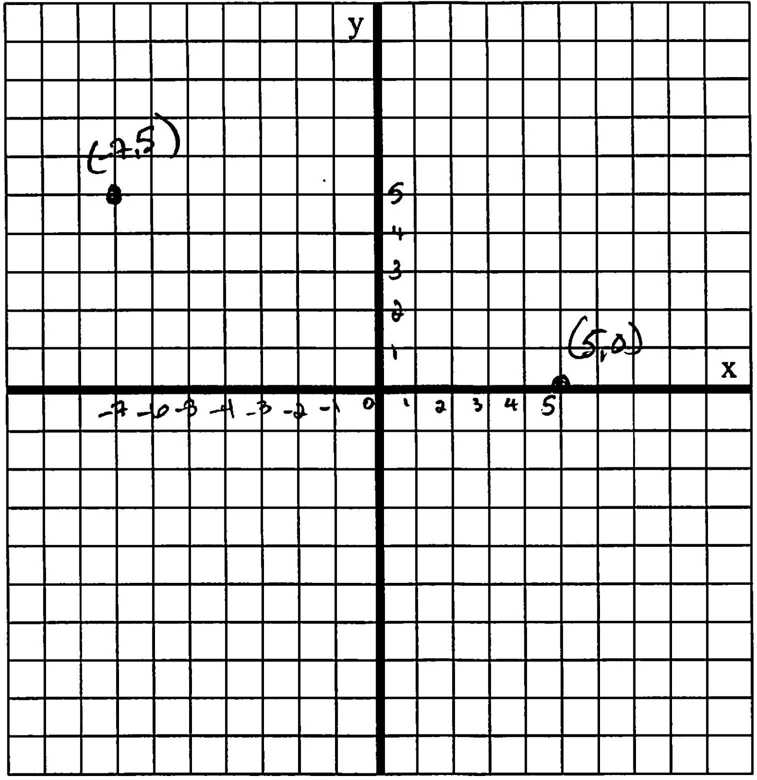
10. A pair of points is given. $(-7,5), (5,0)$

a. Plot the points in a coordinate plane.



$(-7,5) = (x_1, y_1)$
$(5,0) = (x_2, y_2)$

$d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

$M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

b. Find the distance between them.

$$d = \sqrt{(5-(-7))^2 + (0-5)^2} = \sqrt{(5+7)^2+(-5)^2} = \sqrt{(12)^2+(-5)^2} = \sqrt{144+25} = \sqrt{169} = \boxed{13}$$

c. Find the midpoint of the segment that joins them.

$$(x,y) = \left(\frac{-7+5}{2}, \frac{5+0}{2}\right) = \left(\frac{-2}{2}, \frac{5}{2}\right) = \boxed{\left(-1, 5/2\right)}$$

11. Find the x- and y-intercepts of the graph of the equation. (If answer does not exist, enter DNE.)

$5x - 6y = 120$

$(x,0)$ Let $y=0$ X-intercept $= \boxed{(24,0)}$

$(0,y)$ Let $x=0$ Y-intercept $\boxed{(0,-20)}$

x-intercept
$5x - 6(0) = 120$
$\frac{5x}{5} = \frac{120}{5}$
$x = 24$
$(24,0)$

y-intercept
$5(0) - 6y = 120$
$\frac{-6y}{-6} = \frac{120}{-6}$
$y = -20$
$(0,-20)$

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12. Find the slope of the line through P and Q.

$P(5,-5), Q(8,-1)$

$$m = \frac{-1-(-5)}{8-5}$$
$$= \frac{-1+5}{8-5}$$
$$= \boxed{4/3}$$

$(5,-5) = (x_1, y_1)$

$(8,-1) = (x_2, y_2)$

$$m = \frac{y_2-y_1}{x_2-x_1}$$

13. Find the equation of the line that satisfies the given conditions.

Through $(-1,-2)$ and $(6,5)$.

$$m = \frac{5-(-2)}{6-(-1)} = \frac{5+2}{6+1} = \frac{7}{7} = 1$$

use $m=1$ $\quad (-1,-2) = (x_1, y_1)$

$$y - y_1 = m(x - x_1)$$
$$y - (-2) = 1(x - (-1))$$
$$y + 2 = 1(x+1)$$
$$y + 2 = x + 1$$
$$-2 \qquad -2$$
$$\boxed{y = x - 1}$$

$(-1,-2) = (x_1, y_1)$

$(6,5) = (x_2, y_2)$

$$m = \frac{y_2-y_1}{x_2-x_1}$$

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

$y = mx + b$

14. Find all real solution of the equation by factoring. (Enter your answer as a comma-separated list.)

$x^2 - 10x + 24 = 0$

x = $\boxed{4, 6}$

what multiplies to -10 but adds to 24?

$$x^2 - 10x + 24 = 0$$
$$(x-6)(x-4) = 0$$

$x - 6 = 0$
$+6 \quad +6$
$x = 6$

$x - 4 = 0$
$+4 \quad +4$
$x = 4$

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15. Find all real solutions of the equation. (Enter your answers as a comma-separated list. If there is no real solution, enter NO REAL SOLUTION.)

$x^2 - 10x + 1 = 0$

x = $\boxed{5-4\sqrt{6},\ 5+4\sqrt{6}}$

Since no factors of 1 add to 10...
Use the quadratic Formula

$ax^2+bx+c=0$

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

$x^2-10x+1=0$

$a=1 \quad b=-10 \quad c=1$

$x = \frac{-(-10) \pm \sqrt{(-10)^2-4(1)(1)}}{2(1)}$

$= \frac{10 \pm \sqrt{100-4}}{2}$

$= \frac{10 \pm \sqrt{96}}{2} = \frac{10 \pm \sqrt{16 \cdot 6}}{2} = \frac{10}{2} \pm \frac{4\sqrt{6}}{2} = 5 \pm 4\sqrt{6}$

$= 5-4\sqrt{2},\ 5+4\sqrt{6}$

16. Evaluate the product, and write the results in the form $a + bi$.

$(9 - i)(7 + 5i)$

Remember that $\sqrt{-1} = i$
so $i^2 = -1$

$9(7+5i) - i(7+5i)$

$63 + 45i - 7i - 5i^2$

$63 + 38i - 5(-1)$

$63 + 38i + 5 \quad = \boxed{68 + 38i}$

17. Find all real solutions of the equation. (Enter your answers as a comma-separated list.)

$x^3 = 25x$

$\boxed{x = -5, 0, 5}$

1st equation = 0
2nd factor and solve for x.

Remember
$A^2 - B^2 = (A+B)(A-B)$

$x^3 = 25x$
$-25x \quad -25x$

$x^3 - 25x = 0$

$x(x^2 - 25) = 0$

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

$x = 0$

$x + 5 = 0$
$-5 \quad -5$
$x = -5$

$x - 5 = 0$
$+5 \quad +5$
$x = +5$

$\boxed{x = -5, 0, 5}$

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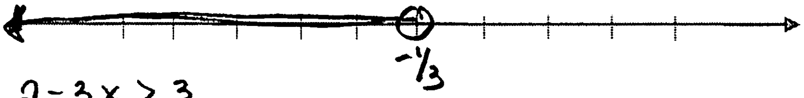
18. Solve the linear inequality. Express the solution using interval notation.

$2 - 3x > 3$

Remember when multiplying or dividing by a negative, the inequality sign switches.

Graph the solution set.



$2 - 3x > 3$
$-2 \quad\quad -2$

$-3x > 1$
$\overline{-3} \quad \overline{-3}$

$x > -\frac{1}{3}$

Interval notation
$(-\infty, -\frac{1}{3})$

19. Solve the equation. (Enter your answers as a comma-separated list. If there is no solution, enter NO SOLUTION.)

$3|x + 6| + 4 = 19$
$-4 \quad -4$

$\frac{3|x+6|}{3} = \frac{15}{3}$

$|x+6| = 5$

When working with absolute values remember

$$|a| = \begin{cases} a & \text{if } a \geq 0 \\ -a & \text{if } a < 0 \end{cases}$$

1st isolate the absolute value term.

If $x+6 > 0$ then

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

$\boxed{x = -1}$

If $x+6 < 0$ then

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

$\boxed{x = -11}$

$\boxed{x = -11, -1}$

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20. Hooke's Law states that the force needed to keep spring stretched *x* units beyond its natural length is directly proportional to *x*. Here the constant of proportionality is called the **spring constant**.

a. Write Hooke's Law as an equation. (Use *k* for the constant of proportionality.)

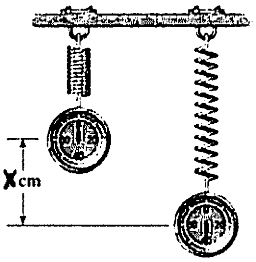
Look at: "the force is directly proportional to x." to write the equation:

Force = kx or

$\boxed{F = kx}$

b. If the spring has a natural length of 6 cm and a force of 35 N is required to maintain the spring stretched to a length of 10 cm, find the spring constant.

$k = \boxed{8.75}$



Force = 35 N

x: stretched length (of the spring) − natural length (of the spring)

x = 10cm − 6cm

x = 4 cm

Force = kx

$\frac{35N}{4} = \frac{k(4\ cm)}{4}$

$k = 35/4 = 8.75\ N/cm$

c. What force is needed to keep the spring stretched to a length of 14 cm?

Find x first: x = stretched length − natural length

x = 14cm − 6cm = 8 cm

F = kx

F = (8.75 N/cm)(8 cm)

$F = \boxed{70\ N}$

21. Find the domain of the function. (Enter your answer using interval notation.)

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

Domain rule for fractions: $\frac{1}{term}$, term ≠ 0

$x^2+x-6 \neq 0$ Factor

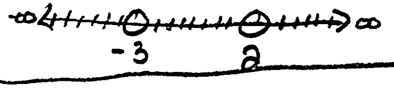
$(x+3)(x-2) \neq 0$

$x+3 \neq 0$
$-3 \quad -3$
$x \neq -3$

$x-2 \neq 0$
$+2 \quad +2$
$x \neq 2$

Everything but x ≠ −3, 2

graph:



$\boxed{(-\infty, -3) \cup (-3, 2) \cup (2, \infty)}$

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22. Complete the table.

$g(x) = |8x + 7|$

x	$g(x)$
-3	$\|8(-3)+7\| = \boxed{17}$
-2	$\|8(-2)+7\| = \boxed{9}$
0	$\|8(0)+7\| = \boxed{7}$
1	$\|8(1)+7\| = \boxed{15}$
3	$\|8(3)+7\| = \boxed{31}$

$|8(-3)+7| = |-24+7| = |-17| = 17$

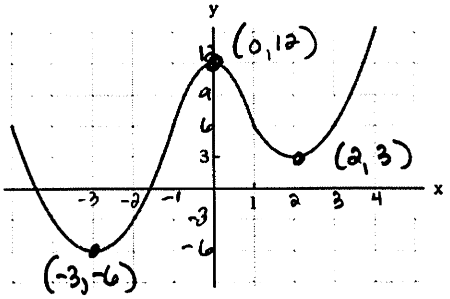
$|8(-2)+7| = |-16+7| = |-9| = 9$

$|8(0)+7| = |0+7| = |7| = 7$

$|8(1)+7| = |8+7| = |15| = 15$

$|8(3)+7| = |24+7| = |31| = 31$

23. The graph of a function is given. Use the graph to estimate the following.



a. All the local maximum and minimum values of the function and the values of x at which each occurs

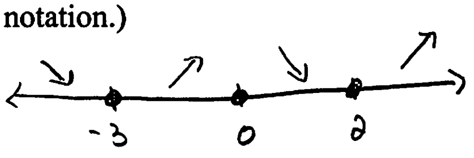
Local Maximum: $(x, y) = \boxed{(0, 12)}$

Local Minimum: $(x, y) = \boxed{(-3, -6)}$

Local Minimum: $(x, y) = \boxed{(2, 3)}$

b. The interval on which the function is increasing and on which the function is decreasing. (Enter your answer using interval notation.)

Increasing: $\boxed{[-3, 0] \cup [2, \infty)}$



Decreasing: $\boxed{(-\infty, -3] \cup [0, 2]}$

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24. A function f is given, and the indicated transformations are applied to its graph (in the given order). Write the equation for the final transformed graph.

$f(x) = x^2$; stretched vertically by a factor of 2, shift downward 8 units, and shift 9 units to the right.

$y = \boxed{2(x-9)^2-8}$

$\underline{\text{Stretch factor}}\left(x \underline{\begin{matrix}+\text{ left}\\-\text{ right}\end{matrix}} \right)^2 \underline{\begin{matrix}+\text{ up}\\-\text{ down}\end{matrix}}$

remember the function

$\_\,(x\ \_)^2\ \_\_$

25. Use $f(x) = 4x - 5$ and $g(x) = 2 - x^2$ to evaluate the expression.

a. $(f \circ g)(x) = f(g(x)) = f(2-x^2) = 4(2-x^2)-5$

$= 8-4x^2-5$

$= \boxed{3-4x^2}$

b. $(g \circ f)(x) = g(f(x)) = g(4x-5) = 2-(4x-5)^2$

$= 2-(4x-5)(4x-5)$

$= 2-(16x^2-20x-20x+25)$

$= 2-16x^2+20x+20x-25$

$\boxed{= -16x^2+40x-23}$

26. Find the function f whose graph is a parabola with the given vertex and that passes through the given point.

Vertex: $(3,-3)$; point: $(4,2)$

$\boxed{f(x) = 5(x-3)^2-3}$

$(3,-3) = (h,k)$ and $(4,2) = (x,y)$

$y = a(x-h)^2+k$

$2 = a(4-3)^2-3$

$2 = a(1)-3$

$2 = 1a-3$

$\underline{+3 \qquad +3}$

$5 = a$

$y = 5(x-3)^2-3$

Standard form:

$f(x) = a(x-h)^2+k$

where (h,k) = vertex

$f(x) = y$.

Find "a" then plug a, (h,k) into the standard form equation.

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27. Find the quotient and remainder using long division.

$$\frac{x^6+4x^4-3x^2-12}{x^2+4}$$

Quotient: $\boxed{x^4-3}$

Remainder $\boxed{0}$

x^4

$x^2+0x+4 \,\big)\, \cancel{x^6}+\cancel{0x^5}+\cancel{4x^4}+0x^3-3x^2+0x-12$

$-\cancel{x^6}-\cancel{0}x^5-\cancel{4}x^4$

$-3\cancel{x^2}+\cancel{0x}-1\cancel{2}$

$+3\cancel{x^2}+\cancel{0}x+1\cancel{2}$

0

$x^4(x^2+0x+4)$

$x^6+0x^5+4x^4$

then subtract.

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

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

then subtract.

28. Find all the zeros of the polynomial. (Enter your answer as a comma-separated list. Enter all answers including repetitions.)

$P(x) = x^3 + 5x^2 + 4x + 20$

$\boxed{x = -5,\ 2i,\ -2i}$

$\underbrace{x^3+5x^2}+\underbrace{4x+20}$

$x^2(x+5)+4(x+5)$

$(x+5)(x^2+4)$

$x+5=0$

$-5\ -5$

$x=-5$

$x^2+4=0$

$-4\ -4$

$x^2=-4$

$\sqrt{x^2}=\sqrt{-4}$

$x=\pm\sqrt{-1\cdot 4}$

$x=\pm 2i$

Factor by grouping

set each factor = 0.

solve for x.

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29. Find the intercepts and asymptotes. (If an answer does not exist, enter DNA. Enter your asymptotes as a comma-separated list of equations if necessary.)

$$s(x) = \frac{(4x-12)}{(x-4)(x+1)}$$

numerator = 0 — X-intercept: $(x, y) = \boxed{(3,0)}$

plug zero in for all x's — Y-intercept: $(x, y) = \boxed{(0,3)}$

Denominator = 0 — Vertical asymptote(s): $\boxed{x=4,\ x=-1}$

Horizontal asymptote: $\boxed{y=0}$

3 rules:
$\frac{ax^n}{bx^m}$ $\begin{cases} n<m & y=0 \\ n=m & y=a/b \\ n>m & \text{none} \end{cases}$

x intercept

$4x-12=0$
$+12 \quad +12$
$4x=12$
$\frac{4x}{4} = \frac{12}{4}$
$x=3$

y intercept

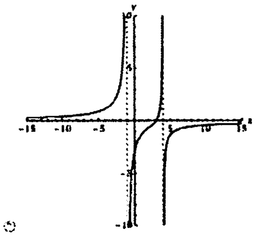
$y=\frac{4(0)-12}{(0-4)(0+1)} = \frac{-12}{(-4)(1)} = 3$

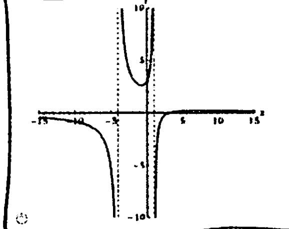
vertical $x-4=0$, $x=4$; $x+1=0$, $x=-1$

horizontal $\frac{4x-12}{(x-4)(x+1)} = \frac{\boxed{4x}-12}{\boxed{x^2}-4x+x-4}$

n=1
m=2

Sketch the graph of the rational function.





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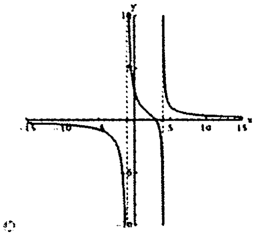

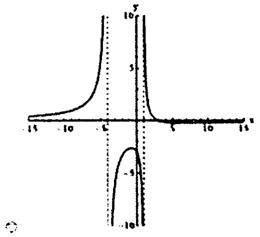

State the domain and range. Use a graphing device to confirm your answer. (Enter your answer using interval notation.)

look at vertical & asymptotes — Domain: $\boxed{(-\infty,-1)\cup(-1,4)\cup(4,\infty)}$

Range: $\boxed{(-\infty,\infty)}$

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30. Use the elimination method to find all solutions of the system of equations.

$$\begin{cases} 3x + 5y = 28 \\ 6x + \ \ y = 11 \end{cases}$$

$(x, y) = \boxed{(1,5)}$

Elimination method:
Want one of the unknown values, x or y. to cancel when equations are added together.

$3x+5y=28$
$6x+y=11$

if you want to cancel the x terms, I could:

$+6(3x+5y=28) \Rightarrow$
$-3(6x+y=11)$

$$\begin{array}{rcl} \cancel{18x} + 30y & = & 168 \\ \cancel{-18x} - 3y & = & -33 \\ \hline 27y & = & 135 \end{array}$$

$$\frac{27y}{27} = \frac{135}{27}$$

$y=5$

$3x+5y=28$
$3x+5(5)=28$

$$\begin{array}{rcl} 3x+25 & = & 28 \\ -25 & & -25 \\ \hline 3x & = & 3 \end{array}$$

$$\frac{3x}{3} = \frac{3}{3}$$

$x=1$

There are easier ways to find the answer, this is just the way I saw first.