GT Pre-Calculus Summer Practice

Complete to the best of your ability without looking at answers that are provided at the end of the document and without a calculator.

Explanations and extra examples if needed:

Algebra 1

http://cpm.org/cca-parent-guide

Algebra 2:

http://cpm.org/cca2-parent-guide

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I. Factoring:

1. $x^2 + 5x + 6$	2. $2x^2 + 5x + 3$	3. $3x^2 + 4x + 1$	4. $3x^2 + 30x + 75$
5. $x^2 + 15x + 44$	6. $x^2 + 7x + 6$	7. $2x^2 + 22x + 48$	8. $x^2 + 4x - 32$
9. $4x^2 + 12x + 9$	10. $24x^2 + 22x - 10$	11. $x^2 + x - 72$	12. $3x^2 - 20x - 7$
13. $x^3 - 11x^2 + 28x$	14. $2x^2 + 11x - 6$	15. $2x^2 + 5x - 3$	16. $x^2 - 3x - 10$
17. $4x^2 - 12x + 9$	18. $3x^2 + 2x - 5$	19. $6x^2 - x - 2$	20. $9x^2 - 18x + 8$

II. Factoring Part 2:

Factor each difference of squares.

1. $x^2 - 16$	2. $x^2 - 25$	3. $64m^2 - 25$
4. $4p^2 - 9q^2$	5. $9x^2y^2 - 49$	6. $x^4 - 25$
7. $64 - y^2$	8. $144 - 25p^2$	9. $9x^4 - 4y^2$

Factor each perfect square trinomial.

10. $x^2 + 4x + 4$	11. $y^2 + 8y + 16$	12. $m^2 - 10m + 25$
13. $x^2 - 8x + 16$	14. $a^2 + 8ab + 16b^2$	15. $36x^2 + 12x + 1$
16. $25x^2 - 30xy + 9y^2$	17. $9x^2y^2 - 6xy + 1$	18. $49x^2 + 1 + 14x$

Factor completely.

19. $9x^2 - 16$	20. $9x^2 + 24x + 16$	21. $9x^2 - 36$
22. $2x^2 + 8xy + 8y^2$	23. $x^2y + 10xy + 25y$	24. $8x^2 - 72$
25. $4x^3 - 9x$	26. $4x^2 - 8x + 4$	27. $2x^2 + 8$

III. Solving Quadratics:

1. $x^2 - x - 12 = 0$
2. $3x^2 - 7x - 6 = 0$
3. $x^2 + x - 20 = 0$
4. $3x^2 + 11x + 10 = 0$
5. $x^2 + 5x = -4$
6. $6x - 9 = x^2$
7. $6x^2 + 5x - 4 = 0$
8. $x^2 - 6x + 8 = 0$
9. $6x^2 - x - 15 = 0$
10. $4x^2 + 12x + 9 = 0$
11. $x^2 - 12x = 28$
12. $2x^2 + 8x + 6 = 0$
13. $2 + 9x = 5x^2$
14. $2x^2 - 5x = 3$
15. $x^2 = 45 - 4x$

IV. Solving using the Quadratic Formula:

Solve each equation by using the Quadratic Formula.

1. $x^2 - x - 2 = 0$
2. $x^2 - x - 3 = 0$
3. $-3x^2 + 2x + 1 = 0$
4. $-2 - 2x^2 = 4x$
5. $7x = 10 - 2x^2$
6. $-6x^2 - x + 6 = 0$
7. $6 - 4x + 3x^2 = 8$
8. $4x^2 + x - 1 = 0$
9. $x^2 - 5x + 3 = 0$
10. $0 = 10x^2 - 2x + 3$
11. $x(-3x + 5) = 7x - 10$
12. $(5x + 5)(x - 5) = 7x$

V. Solving Advanced Equations:

Solve each equation. Find all solutions.

1. $\frac{3x+1}{2}=5$
2. $4(x-1)+3=15$
3. $\sqrt{2x+5}=10$
4. $10-(x+7)=5$
5. $3(2x-7)=-21$
6. $8+\left(\frac{y}{2}\right)=10$
7. $\sqrt{x}-3=7$
8. $(x+1)^2=81$
9. $\frac{x}{2}-\frac{x}{5}=3$
10. $|x-2|=5$
11. $2\sqrt{x-3}=8$
12. $4(x-1)=16$
13. $|2x+1|=9$
14. $\frac{y+7}{3}=10$
15. $\frac{m}{3}-\frac{2m}{5}=\frac{1}{5}$
16. $x^2+5=4$
17. $\frac{3y-1}{3}=10$
18. $2(3x-1)+7=-13$
19. $(y-1)^2=9$
20. $20-(3x)=10$

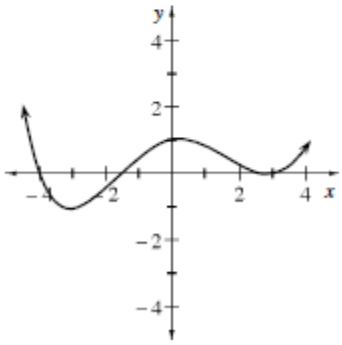
VI. Transforming Parent Functions:

For each of the following equations, state the parent equation and then sketch its graph. Be sure to include any key and/or locator points.

1. $y=(x-5)^2$
2. $y=-\frac{1}{3}(x+4)^2+7$
3. $(x-2)^2+(y+1)^2=9$
4. $y=|x+5|-2$
5. $y=\frac{1}{x+1}+10$
6. $y=2^x-8$
7. $y=-(x-2)^3+1$
8. $y=\sqrt{x+7}$
9. $y=3|x-5|$
10. $y=\pm\sqrt{x-9}$

For each of the following problems, state whether or not it is a function. If it is not a function, explain why not.

11.



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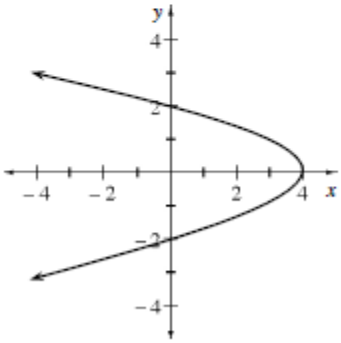


13. $y=7\pm\sqrt{9-x^2}$
14. $y=3(x-4)^2$

VII. Simplifying Rational Expressions

Simplify each of the following expressions completely. Assume the denominator does not equal zero.

1. $\frac{2(x+3)}{4(x-2)}$
2. $\frac{2(x-3)}{6(x+2)}$
3. $\frac{2(x+3)(x-2)}{6(x-2)(x+2)}$
4. $\frac{4(x-3)(x-5)}{6(x-3)(x+2)}$
5. $\frac{3(x-3)(4-x)}{15(x+3)(x-4)}$
6. $\frac{15(x-1)(7-x)}{25(x+1)(x-7)}$
7. $\frac{24(y-4)(y-6)}{16(y+6)(6-y)}$
8. $\frac{36(y+4)(y-16)}{32(y+16)(16-y)}$
9. $\frac{(x+3)^2(x-2)^4}{(x+3)^4(x-2)^3}$
10. $\frac{(5-x)^2(x-2)^2}{(x+5)^4(x-2)^3}$
11. $\frac{(5-x)^4(3x-1)^2}{(x-5)^4(3x-2)^3}$
12. $\frac{12(x-7)(x+2)^4}{20(x-7)^2(x+2)^5}$
13. $\frac{x^2+5x+6}{x^2+x-6}$
14. $\frac{2x^2+x-3}{x^2+4x-5}$
15. $\frac{x^2+4x}{2x+8}$
16. $\frac{24(3x-7)(x+1)^6}{20(3x-7)^3(x+1)^5}$
17. $\frac{x^2-1}{(x+1)(x-2)}$
18. $\frac{x^2-4}{(x+1)^2(x-2)}$
19. $\frac{x^2-4}{x^2+x-6}$
20. $\frac{x^2-16}{x^3+9x^2+20x}$
21. $\frac{2x^2-x-10}{3x^2+7x+2}$

VIII. Solving Systems of Equations:

Solve each of the following systems for x and y. Then explain what the answer tells you about the graphs of the equations. Be sure to check your work.

1. $x+y=11$
   $3x-y=5$

2. $2x-3y=-19$
   $-5x+2y=20$

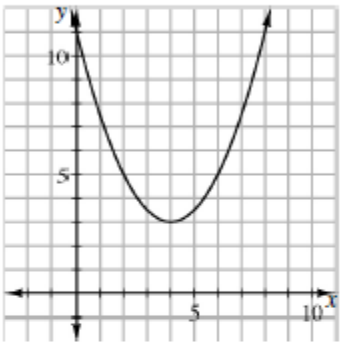
3. $15x+10y=21$
   $6x+4y=11$

4. $8x+2y=18$
   $-6x+y=14$

5. $12x-16y=24$
   $y=\frac{3}{4}x-\frac{3}{2}$

6. $\frac{1}{2}x-7y=-15$
   $3x-4y=24$

The graph of $y=\frac{1}{2}(x-4)^2+3$ is shown at right. Use the graph to solve each of the following equations. Explain how you get your answer.



7. $\frac{1}{2}(x-4)^2+3=3$
8. $\frac{1}{2}(x-4)^2+3=5$
9. $\frac{1}{2}(x-4)^2+3=1$
10. $\frac{1}{2}(x-4)^2=8$

Solve each equation below. Think about rewriting, looking inside, or undoing to simplify the process.

11. $3(x-4)^2+6=33$

12. $\frac{x}{4}+\frac{x}{5}=\frac{9x-4}{20}$

13. $3+\left(\frac{10-3x}{2}\right)=5$

14. $-3\sqrt{2x-1}+4=10$

Solve each of the following systems of equations algebraically. What does the solution tell you about the graph of the system?

15. $y=-\frac{2}{3}x+7$
    $4x+6y=42$

16. $y=(x+1)^2+3$
    $y=2x+4$

17. $y=-3(x-4)^2-2$
    $y=-\frac{4}{7}x+4$

18. $x+y=0$
    $y=(x-4)^2-6$

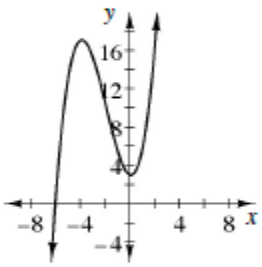
19. Adult tickets for the *Mr. Moose's Fantasy Show on Ice* are \$6.50 while a child's ticket is only \$2.50. At Tuesday night's performance, 435 people were in attendance. The box office brought in \$1667.50 for that evening. How many of each type of ticket were sold?

IX. Inverses:

Find the inverse of each of the following functions.

1. $f(x) = 8(x - 13)$
2. $y = -\frac{3}{4}x + 6$
3. $y = \frac{5(x+2)}{3}$
4. $f(x) = x^2 + 6$
5. $f(x) = \frac{3}{x} + 6$
6. $g(x) = \frac{5}{x}$
7. $g(x) = (x + 1)^2 - 3$
8. $y = (x + 2)^3$
9. $y = 3 + \sqrt{x - 4}$
10. $g(x) = 6x + 2$

Sketch the graph of the inverse of each of the following functions.

11. $y = \frac{x}{6} + 2$
12. $f(x) = 2x^2 - 1$
13. $g(x) = x$
14. $y = \frac{1}{5x}$
15. 

For each of the following pairs of functions, determine $f(g(x))$ and $g(f(x))$, then use the result to decide whether or not $f(x)$ and $g(x)$ are inverses of each other.

16. $f(x) = 5x + 7$
$g(x) = \frac{x-7}{5}$
17. $f(x) = 8x$
$g(x) = \frac{1}{8}x$
18. $f(x) = x + 5$
$g(x) = \frac{1}{x+5}$
19. $f(x) = \frac{2}{3x}$
$g(x) = \frac{3x}{2}$
20. $f(x) = \frac{2}{3}x + 6$
$g(x) = \frac{3(x-6)}{2}$
21. $f(x) = x\sqrt{3} + 9$
$g(x) = \left(\frac{x-9}{\sqrt{3}}\right)^2$

X. Trigonometry:

Graph each of the following trig equations.

1. $y = \sin(x)$
2. $y = \cos(x)$
3. $y = \tan(x)$

Find each of the following values without using a calculator, but by using what you know about right triangle trigonometry, the unit circle, and special right triangles.

4. $\cos(180^\circ)$
5. $\sin(360^\circ)$
6. $\tan(45^\circ)$
7. $\cos(-90^\circ)$
8. $\sin(150^\circ)$
9. $\tan(240^\circ)$

Convert each of the angle measures.

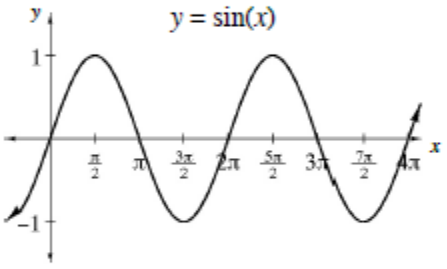
10. 60° to radians
11. 170° to radians
12. 315° to radians
13. $\frac{\pi}{15}$ radians to degrees
14. $\frac{13\pi}{8}$ radians to degrees
15. $-\frac{3\pi}{4}$ radians to degrees

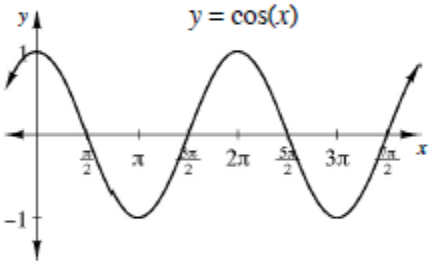
XI. Trigonometric Functions:

For each equation listed below, state the amplitude and period.

5. $y = 2\cos(3x) + 7$
6. $y = \frac{1}{2}\sin(x) - 6$
7. $f(x) = -3\sin(4x)$
8. $y = \sin\left[\frac{1}{3}x\right] + 3.5$
9. $f(x) = -\cos(x) + 2\pi$
10. $f(x) = 5\cos(x-1) - \frac{1}{4}$

Below are the graphs of $y = \sin(x)$ and $y = \cos(x)$.





Use them to sketch the graphs of each of the following equations and functions by hand. Use your graphing calculator to check your answer.

11. $y = -2\sin(x + \pi)$
12. $f(x) = \frac{1}{2}\sin(3x)$
13. $f(x) = \cos\left(4\left(x - \frac{\pi}{4}\right)\right)$
14. $y = 3\cos\left(x + \frac{\pi}{4}\right) + 3$
15. $f(x) = 7\sin\left(\frac{1}{4}x\right) - 3$

XII. Polynomials:

State whether or not each of the following is a polynomial function. If it is, give the degree. If it is not, explain why not.

1. $\frac{1}{8}x^7 + 4.23x^6 - x^4 - \pi x^2 + \sqrt{2}x - 0.1$

2. $45x^3 - 0.75x^2 - \frac{3}{100}x + \frac{5}{x} + 15$

3. $x(x+2)\left(6+\frac{1}{x}\right)$

Sketch the graph of each of the following polynomials.

4. $y = (x+5)(x-1)^2(x-7)$

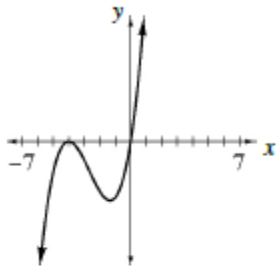
5. $y = -(x+3)(x^2+2)(x+5)^2$

6. $f(x) = -x(x+8)(x+1)$

7. $y = x(x+4)(x^2-1)(x-4)$

Below are the complete graphs of some polynomial functions. Based on the shape and location of the graph, describe all the roots of the polynomial function, its degree, and orientation. Be sure to include information such as whether or not a root is a double or triple root.

8.



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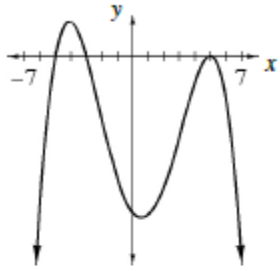

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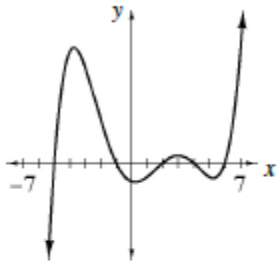
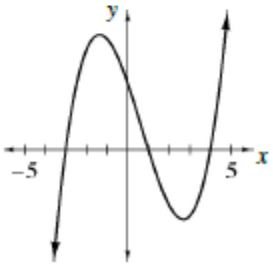
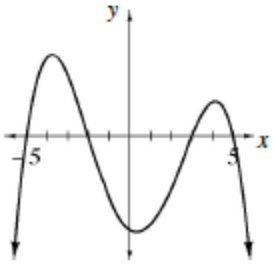


Using the graphs below and the given information, write the specific equation for each polynomial function.

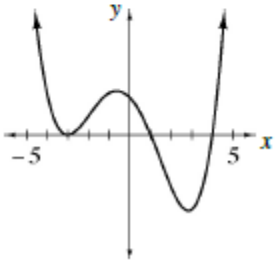
11. y-intercept: $(0, 12)$



12. y-intercept: $(0, -15)$



13. y-intercept: $(0, 3)$



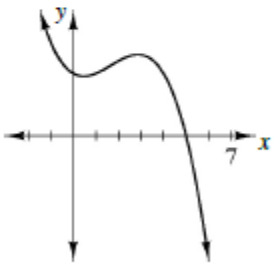
XIII. Complex Numbers:

Simplify the following expressions.

1. $(6 + 4i) - (2 - i)$
2. $8i - \sqrt{-16}$
3. $(-3)(4i)(7i)$
4. $(5 - 7i)(-2 + 3i)$
5. $(3 + 2i)(3 - 2i)$
6. $(\sqrt{3} - 5i)(\sqrt{3} + 5i)$

Below are the *complete* graphs of some polynomial functions. Based on the shape and location of the graph, describe all the roots of the polynomial function. Be sure to include information such as whether roots are double or triple, real or complex, etc.

7.



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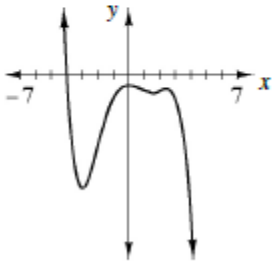

9. Write the specific equation for the polynomial function passing through the point (0, 5), and with roots $x = 5$, $x = -2$ and $x = 3i$.

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I. Factoring Answers:

1. $(x+2)(x+3)$
2. $(x+1)(2x+3)$
3. $(3x+1)(x+1)$
4. $3(x+5)(x+5)$
5. $(x+11)(x+4)$
6. $(x+6)(x+1)$
7. $2(x+8)(x+3)$
8. $(x+8)(x-4)$
9. $(2x+3)(2x+3)$
10. $2(3x-1)(4x+5)$
11. $(x-8)(x+9)$
12. $(x-7)(3x+1)$
13. $x(x-4)(x-7)$
14. $(x+6)(2x-1)$
15. $(x+3)(2x-1)$
16. $(x-5)(x+2)$
17. $(2x-3)(2x-3)$
18. $(3x+5)(x-1)$
19. $(2x+1)(3x-2)$
20. $(3x-4)(3x-2)$

II. Factoring Part 2 Answers:

1. $(x+4)(x-4)$
2. $(x+5)(x-5)$
3. $(8m+5)(8m-5)$
4. $(2p+3q)(2p-3q)$
5. $(3xy+7)(3xy-7)$
6. $(x^2+5)(x^2-5)$
7. $(8+y)(8-y)$
8. $(12+5p)(12-5p)$
9. $(3x^2+2y)(3x^2-2y)$
10. $(x+2)^2$
11. $(y+4)^2$
12. $(m-5)^2$
13. $(x-4)^2$
14. $(a+4b)^2$
15. $(6x+1)^2$
16. $(5x-3y)^2$
17. $(3xy-1)^2$
18. $(7x+1)^2$
19. $(3x+4)(3x-4)$
20. $(3x+4)^2$
21. $9(x+2)(x-2)$
22. $2(x+2y)^2$
23. $y(x+5)^2$
24. $8(x+3)(x-3)$
25. $x(2x+3)(2x-3)$
26. $4(x-1)^2$
27. $2(x^2+4)$

III. Solving Quadratics Answers:

1. $x = 4$ or -3
2. $x = -\frac{2}{3}$ or 3
3. $x = -5$ or 4
4. $x = -\frac{5}{3}$ or -2
5. $x = -4$ or -1
6. $x = 3$
7. $x = -\frac{4}{3}$ or $\frac{1}{2}$
8. $x = 4$ or 2
9. $x = -\frac{3}{2}$ or $\frac{5}{3}$
10. $x = -\frac{3}{2}$
11. $x = 14$ or -2
12. $x = -1$ or -3
13. $x = -\frac{1}{5}$ or 2
14. $x = -\frac{1}{2}$ or 3
15. $x = 5$ or -9

IV. Solving using the Quadratic Formula Answers:

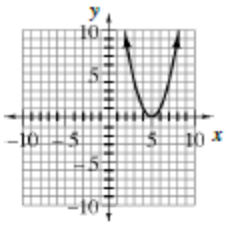
1. $x = 2$ or -1
2. $x = \frac{1 \pm \sqrt{13}}{2}$ ≈ 2.30 or -1.30
3. $x = -\frac{1}{3}$ or 1
4. $x = -1$
5. $x = \frac{-7 \pm \sqrt{129}}{4}$ ≈ 1.09 or -4.59
6. $x = \frac{1 \pm \sqrt{145}}{-12}$ ≈ -1.09 or 0.92
7. $x = \frac{4 \pm \sqrt{40}}{6} = \frac{2 \pm \sqrt{10}}{3}$ ≈ 1.72 or -0.39
8. $x = \frac{-1 \pm \sqrt{17}}{8}$ ≈ 0.39 or -0.64
9. $x = \frac{5 \pm \sqrt{13}}{2}$ ≈ 4.30 or 0.70
10. no solution
11. $x = \frac{2 \pm \sqrt{124}}{-6} = \frac{1 \pm \sqrt{31}}{-3}$ ≈ -2.19 or 1.52
12. $x = \frac{27 \pm \sqrt{1229}}{10}$ ≈ 6.21 or -0.81

V. Solving Advanced Equations Answers:

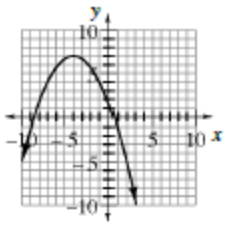
1. $x = 3$
2. $x = 4$
3. $x = \frac{95}{2} = 47.5$
4. $x = -2$
5. $x = 0$
6. $y = 4$
7. $x = 100$
8. $x = 8$ or -10
9. $x = 10$
10. $x = 7$ or -3
11. $x = 19$
12. $x = 5$
13. $x = 4$ or -5
14. $y = 23$
15. $m = -3$
16. no solution
17. $y = \frac{31}{3} = 10.\overline{3}$
18. $x = -3$
19. $y = 4$ or -2
20. $x = \frac{10}{3}$

VI. Transforming Parent Function Answers:

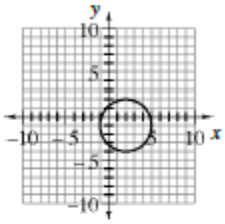
1. Parent graph $f(x)=x^2$, vertex $(5, 0)$



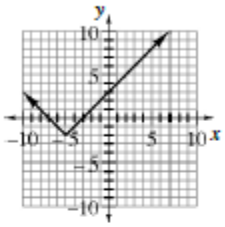
2. Parent graph $f(x)=x^2$, vertex $(-4, 7)$



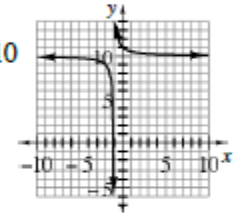
3. Parent graph $(x-h)^2+(y-k)^2=r^2$, center $(2, -1)$, radius 3



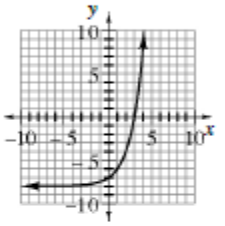
4. Parent graph $f(x)=|x|$, vertex $(-5, -2)$



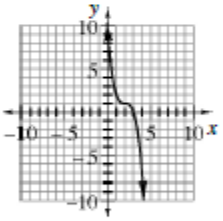
5. Parent graph $f(x)=\frac{1}{x}$, asymptotes $x=-1, y=10$



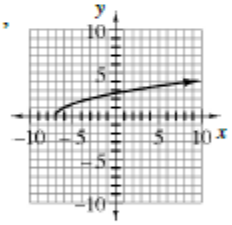
6. Parent graph $f(x)=2^x$, asymptote $x=-8$



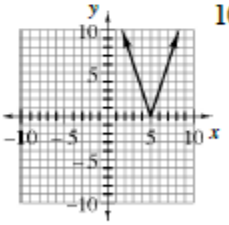
7. Parent graph $f(x)=x^3$, locator point $(2, 1)$



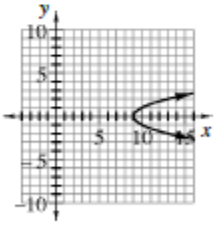
8. Parent graph $f(x)=\sqrt{x}$, vertex $(-7, 0)$



9. Parent graph $f(x)=|x|$, vertex $(5, 0)$



10. Parent graph $y^2=x$, vertex $(9, 0)$



11. Yes.

12. No, on the left part of the graph, for each x-value there are two possible y-values. You can see this by drawing a vertical line through the graph. If a vertical line passes through the graph more than once, it is not a function.

13. No, because the equation has "±," for each value substituted for x, there will be two y-values produced. A function can have only one output for each input.

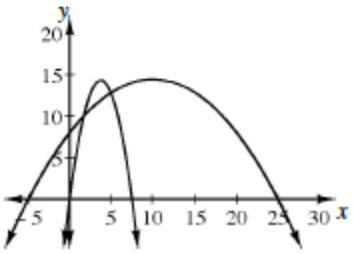
14. Yes.

VII. Simplifying Rational Expressions Answers:

1. $\frac{(x+3)}{2(x-2)}$
2. $\frac{(x-3)}{3(x+2)}$
3. $\frac{(x+3)}{3(x+2)}$
4. $\frac{2(x-5)}{3(x+2)}$
5. $-\frac{(x-3)}{5(x+3)}$
6. $-\frac{3(x-1)}{5(x+1)}$
7. $-\frac{3(y-4)}{2(y+6)}$
8. $-\frac{9(y+4)}{8(y+16)}$
9. $\frac{(x-2)}{(x+3)^2}$
10. $\frac{(5-x)^2}{(x+5)^4(x-2)}$
11. $\frac{(3x-1)^2}{(3x-2)^3}$
12. $\frac{3}{5(x-7)(x+2)}$
13. $\frac{x+2}{x-2}$
14. $\frac{2x+3}{x+5}$
15. $\frac{x}{2}$
16. $\frac{6(x+1)}{5(3x-7)^2}$
17. $\frac{x-1}{x-2}$
18. $\frac{x+2}{(x+1)^2}$
19. $\frac{x+2}{x+3}$
20. $\frac{x-4}{x(x+5)}$
21. $\frac{2x-5}{3x+1}$

VIII. Solving Systems of Equations Answers

1. $(4, 7)$
2. $(-2, 5)$
3. no solution
4. $\left(-\frac{1}{2}, 11\right)$
5. All real numbers
6. $(12, 3)$
7. $x = 4$. The horizontal line $y = 3$ crosses the parabola in only one point, at the vertex.
8. $x = 2, x = 6$
9. No solution. The horizontal line $y = 1$ does not cross the parabola.
10. $x = 0, x = 8$. Add three to both sides to rewrite the equation as $\frac{1}{2}(x-4)^2 + 3 = 11$. The horizontal line $y = 11$ crosses at these two points.
11. $x = 7, x = 1$
12. no solution
13. $x = 2$
14. no solution (A square root must have a positive result.)
15. All real numbers. When graphed, these equations give the same line.
16. $(0, 4)$. The parabola and the line intersect only once.
17. No solution. This parabola and this line do not intersect.
18. $(2, -2)$ and $(5, -5)$. The line and the parabola intersect twice.
19. 145 adult tickets were sold, while 290 child tickets were sold.
20. There are 35 three-point questions and 15 six-point questions on the test.
21. By graphing we see that the nemesis' balloon when launched at the base of the wall (the y-axis), hits the path of the Dudley's water balloon. Therefore, if timed correctly, the nemesis is successful.



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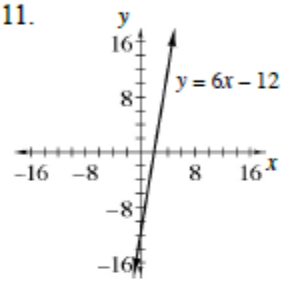
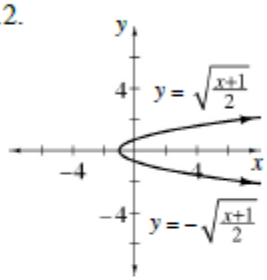
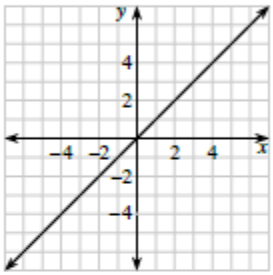
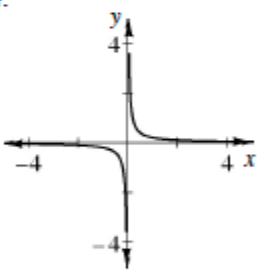
IX: Inverses:

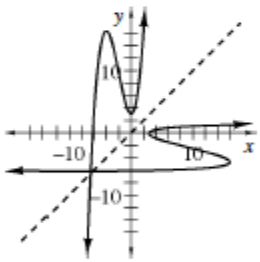
1. $y=\frac{x}{8}+13$
2. $y=-\frac{4}{3}x+8$
3. $y=\frac{3}{5}x-2$
4. $y=\pm\sqrt{x-6}$
5. $y=\frac{3}{x-6}$
6. $y=\frac{5}{x}$
7. $y=-1\pm\sqrt{x+3}$
8. $y=-2+\sqrt[3]{x}$
9. $y=(x-3)^2+4$, for $x\geq 3$
10. $y=\frac{x-2}{6}$

11. 

12. 

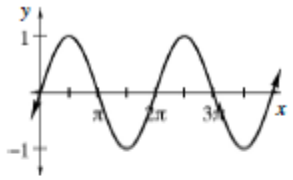
13. 

14. 

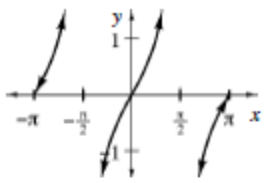
15. 

16. $f(g(x))=g(f(x))=x$. They are inverses.
17. $f(g(x))=g(f(x))=x$. They are inverses.
18. $f(g(x))=\frac{1}{x+5}+5$, $g(f(x))=\frac{1}{x+10}$. No, they are not inverses.
19. $f(g(x))=\frac{4}{9x}$, $g(f(x))=\frac{1}{x}$. No, they are not inverses.
20. $f(g(x))=g(f(x))=x$. They are inverses.
21. $f(g(x))=\frac{\sqrt{3(x-9)^2}}{3}+9$, $g(f(x))=x^2$. No, they are not inverses.

IX. Trigonometry Answers:

1. 

2. 

3. 

4. –1

5. 0

6. 1

7. 0

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

9. $\sqrt{3}$

10. $\frac{\pi}{3}$ radians

11. $\frac{17\pi}{18}$ radians

12. $\frac{7\pi}{4}$ radians

13. 12°

14. 292.5°

15. –135°

XI: Trigonometric Functions Answers:

1.  Amplitude is 2, period is π.

2.  Amplitude 0.5, period 2π.

3. The graph shows one cycle already. Amplitude is 3 and period is 4π.

4.  Amplitude is 2.5, period is $\frac{\pi}{3}$.

5. Amplitude: 2, period: $\frac{2\pi}{3}$.

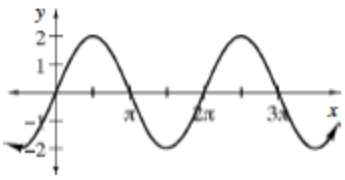
6. Amplitude: $\frac{1}{2}$, period: 2π.

7. Amplitude: 3, period: $\frac{\pi}{2}$.

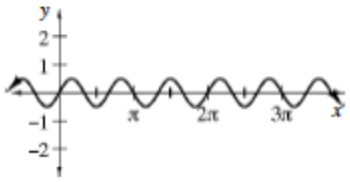
8. Amplitude: 1, period: 6π.

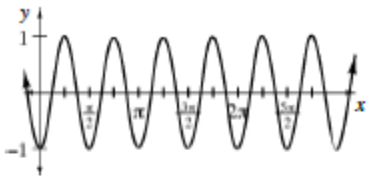
9. Amplitude: 1, period: 2π.

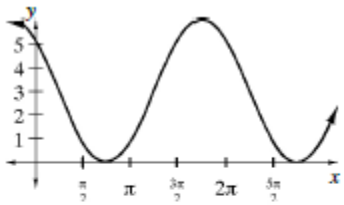
10. Amplitude: 5, period: 2π.

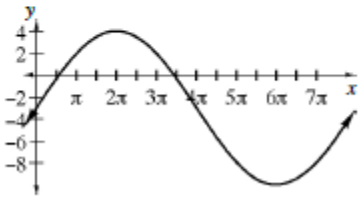
11. 

Surprised? The negative flips it over, but the "+ π" shifts it right back to how it looks originally!

12. 

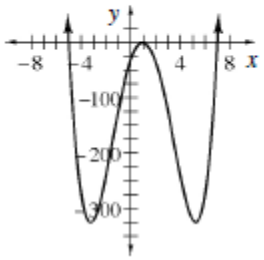
13. 

14. 

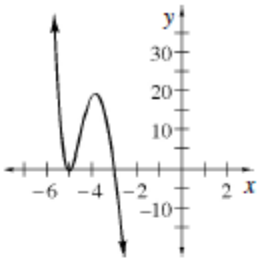
15. 

XII. Polynomials Answers:

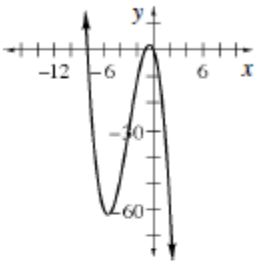
1. Yes, degree 7.
2. No. You cannot have x in the denominator.
3. No. When you multiply this out, you will still have x in the denominator.
4. The roots are $x = -5$, 1, and 7 with $x = 1$ being a double root. Remember a double root is where the graph is tangent. This graph has a positive orientation.



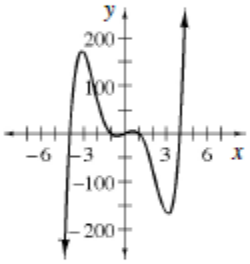
5. The roots are $x = -3$ and $x = -5$, which is a double root. The $x^2 + 2$ term does not produce any real roots since this expression cannot equal zero. The orientation is negative. The graph crosses the y-axis at $y = -150$.



6. This graph has negative orientation and the roots are $x = -8, -1$, and 0. Be sure to include $x = 0$ as a root.



7. $x^2 - 1$ gives us two roots. Since it factors to $(x + 1)(x - 1)$, the five roots are: $x = -4, -1, 0, 1$, and 4. The graph has a positive orientation.



8. A third degree polynomial (cubic) with one root at $x = 0$, and one double root at $x = -4$. It has a positive orientation.

9. A fourth degree polynomial with real roots at $x = -5$ and -3, and a double root at $x = 5$. It has a negative orientation.

10. A fifth degree polynomial with five real roots: $x = -5, -1, 2, 4$, and 6. It has a positive orientation.

11. $y = (x + 3)(x - 1)(x - 4)$

12. $y = -0.1(x + 5)(x + 2)(x - 3)(x - 5)$

13. $y = \frac{1}{12}(x + 3)^2(x - 1)(x - 4)$

XIII. Complex Numbers Answers:

1. $4 + 5i$
2. $4i$
3. 84
4. $11 + 29i$
5. 13
6. 28
7. A third degree polynomial with negative orientation and with one real root at $x = 5$ and two complex roots.
8. A fifth degree polynomial with negative orientation and with one real root at $x = -4$ and four complex roots.
9. $y = -\frac{1}{18}\left(x^2 - 3x - 10\right)\left(x^2 + 9\right)$