East-West | Name:
AP Calculus/ Markinson | Date:

This packet includes a sampling of problems that students *entering* AP Calculus should be able to answer.

In Calculus, it's rarely the calculus that you will get stuck on; it's the algebra. Students entering AP Calculus *must* have a strong foundation in algebra. Most questions in this packet were included because they concern skills and concepts that will be used extensively in AP Calculus. Others have been included not so much because they are skills that are used frequently, but because being able to answer them indicates a strong grasp of important mathematical concepts and—more importantly—the ability to solve problems.

You will be expected to approach problems with the mathematical *understanding* needed to make sense of unusual problems. This is <u>not</u> a class where every problem you see on tests and quizzes is identical to problems you've done dozens of times in class. This is because the AP test itself (and, truly, all "real" mathematics) requires you to *apply* what you have learned.

If you have the basics down and you put in the work needed, you'll see how amazing Calculus is! AP Calculus is challenging, demanding, rewarding, and—to put it simply—totally awesome.

*QUESTIONS? NEED HELP?* **Email Ms. Markinson at mmarkinson@ewsis.org. Do not hesitate to ask for help!**

**PART 1:**

# Basic Algebra Skills

**A1.** True or false? If false, change what is underlined to make the statement true.

**a.** $\left(x^3\right)^4 = x^{\underline{12}}$ T F

**b.** $x^{\frac{1}{2}}x^3 = x^{\underline{\frac{3}{2}}}$ T F

**c.** $(x + 3)^2 = \underline{x^2 + 9}$ T F

**d.** $\dfrac{x^2 - 1}{x - 1} = \underline{x}$ T F

**e.** $(4x + 12)^2 = \underline{16}(x + 3)^2$ T F

**f.** $\underline{3} + 2\sqrt{x-3} = 5\sqrt{x-3}$ T F

**g.** If $(x + 3)(x - 10) = \underline{2}$, then $x + 3 = \underline{2}$ or $x - 10 = \underline{2}$. T F

**A2.** More basic algebra.

**a.** If 6 is a zero of $f$, then ____ is a solution of $f(2x) = 0$.

**b.** Lucy has the equation $2(4x + 6)^2 - 8 = 16$. She multiplies both sides by ½. If she does this correctly, what is the resulting equation?

**c.** Simplify $\dfrac{2 \pm 4\sqrt{10}}{2}$.

**d.** Rationalize the denominator of $\dfrac{12}{3 + \sqrt{x-1}}$.

**e.** If $f(x) = 3x^2 + x + 5$, then $f(x + h) - f(x) =$ (Give your answer in simplest form.)

**f.** A cone's volume is given by $V = \frac{1}{3}\pi r^2 h$. If $r = 3h$, write $V$ in terms of $h$.

**g.** Write an expression for the area of an equilateral triangle with side length $s$.

**h.** Suppose an isosceles <u>right</u> triangle has hypotenuse $h$. Write an expression for its perimeter in terms of $h$.

**Trigonometry**

You should be able to answer these quickly, *without* a calculator.

**T1.** Find the value of each expression, in exact form.

**a.** $\sin\frac{2\pi}{3}$

**b.** $\cos\frac{11\pi}{6}$

**c.** $\tan\frac{3\pi}{4}$

**d.** $\sec\frac{5\pi}{3}$

**e.** $\csc\frac{7\pi}{4}$

**f.** $\cot\frac{5\pi}{6}$

**T2.** Solve by factoring. Find the value(s) of $x$ in $[0, 2\pi)$, if any, which solve each equation.

**a.** $4\sin^2 x + 4\sin x + 1 = 0$

**b.** $\cos^2 x - \cos x = 0$

**c.** $\sin x \cos x - \sin^2 x = 0$

**d.** $x\tan x + 3\tan x = x + 3$

## Higher-Level Factoring

**F1.** Solve by factoring.

**a.** $x^3 + 5x^2 - x - 5 = 0$

**b.** $4x^4 + 36 = 40x^2$

**c.** $(x^3 - 6)^2 + 3(x^3 - 6) - 10 = 0$

**F2.** Solve by factoring. You should be able to solve each of these *without* multiplying the whole thing out. (In fact, please *don't* multiply it all out!)

**a.** $(x + 2)^2 (x + 6)^3 + (x + 2)(x + 6)^4 = 0$

**b.** $(2x - 3)^3 (x^2 - 9)^2 + (2x - 3)^5 (x^2 - 9) = 0$

**c.** $(3x + 11)^5(x + 5)^2 (2x - 1)^3 + (3x + 11)^4 (x + 5)^4 (2x - 1)^3 = 0$

**d.** $6x^2 - 5x - 4 = (2x + 1)^2(3x - 4)^2$

**F3.** **Solve.** Each question *can* be solved by factoring, but there are other methods, too.

**a.** $a(3a + 2)^{1/2} + 2(3a + 2)^{3/2} = 0$

**b.** $\sqrt{2x^2 + x - 6} + \sqrt{2x - 3} = 0$

**c.** $2\sqrt{x + 3} = x + 3$

**d.** $\dfrac{6}{(2x + 1)^2} + \dfrac{3}{2x + 1} = 1 + \dfrac{2}{2x + 1}$

## Rational Expressions and Equations

**R1.**

| | Function | Domain |
|---|---|---|
| **a.** | $f(x)=\dfrac{4x^2+7x-15}{8x^2-14x+5}$ | |
| **b.** | $f(x)=\dfrac{3(4+x)^2-48}{x}$ | |
| **c.** | $f(x)=\dfrac{6x+4}{\sqrt{3x^2-10x-8}}$ | |

**R2.** Simplify completely.

**a.** $\dfrac{2}{\sqrt{x^2+4}}-\dfrac{x^2+4}{3}$ (Don't worry about rationalizing)

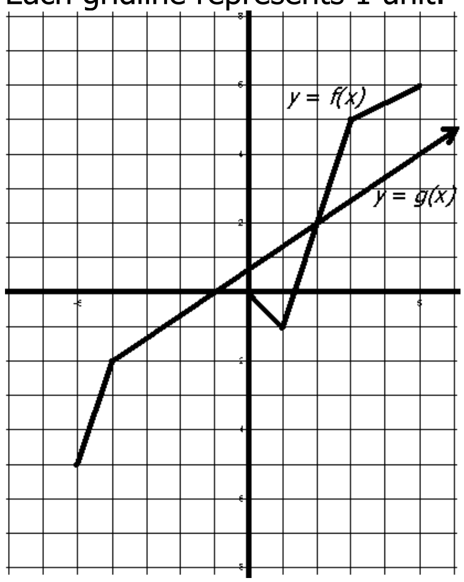
**b.** $\dfrac{3}{\left(\frac{4}{x}\right)^2+1}$ (Your final answer should have just one numerator and one denominator)

**c.** $\dfrac{5}{x^2+3x+2}-\dfrac{2x}{x^2+2x+1}$

**d.** $\dfrac{3}{(x+2)^{1/2}}+\dfrac{x}{(x+2)^{5/2}}$ (Don't worry about rationalizing)

## Graphing

**G1.** The graphs of $f$ and $g$ are given. Answer each question, if possible. If impossible, explain why. Each gridline represents 1 unit.




**a.** $f^{-1}(5) =$

**b.** $f(g(5)) =$

**c.** $(g(f(3)) =$

**d.** Solve for $x$: $f(g(x)) = 5$

**e.** Solve for $x$: $f(x) = g(x)$

For parts **f** – **i**, respond in interval notation.

**f.** For what values of $x$ is $f(x)$ increasing?

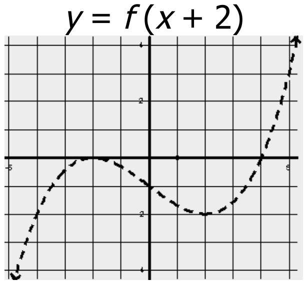
**g.** For what values of $x$ is $g(x)$ positive?

**h.** Solve for $x$: $f(x) < 5$

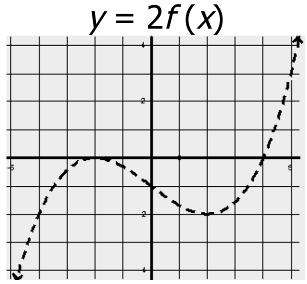
**i.** Solve for $x$: $f(x) \geq g(x)$

**G2.** Given the graph of $y = f(x)$ (dashed graph), sketch each transformed graph.

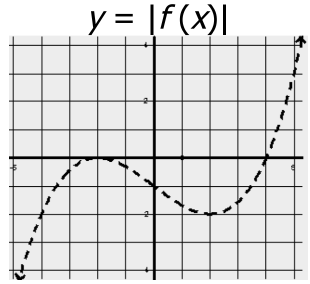
**a.** $y = f(x + 2)$



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



**c.** $y = |f(x)|$



PART 2:

*Summer Review Packet for Students Entering* Calculus

**Radicals:**

To simplify means that 1) no radicand has a perfect square factor and
2) there is no radical in the denominator (rationalize).

Recall – the **Product Property** $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$ and the **Quotient Property** $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

**Examples**: Simplify $\sqrt{24} = \sqrt{4} \cdot \sqrt{6}$ find a perfect square factor
$= 2\sqrt{6}$ simplify

Simplify $\sqrt{\frac{7}{2}} = \frac{\sqrt{7}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$ split apart, then multiply both the numerator and the denominator by $\sqrt{2}$

$= \frac{\sqrt{14}}{\sqrt{4}} = \frac{\sqrt{14}}{2}$ multiply straight across and simplify

If the denominator contains 2 terms –
multiply the numerator and the denominator by the ***conjugate*** of the denominator
The ***conjugate*** of $3+\sqrt{2}$ is $3-\sqrt{2}$ (the sign changes between the terms).

**Simplify each of the following.**

1. $\sqrt{32}$

2. $\sqrt{(2x)^8}$

3. $\sqrt[3]{-64}$

4. $\sqrt{49m^2n^8}$

5. $\sqrt{\frac{11}{9}}$

6. $(\sqrt{5}-\sqrt{6})(\sqrt{5}+\sqrt{2})$

**Rationalize.**

7. $\frac{1}{\sqrt{2}}$

8. $\frac{3}{2-\sqrt{5}}$

**Complex Numbers:**

Form of complex number - $a+bi$

Where $a$ is the "real" is part and $bi$ is the "imaginary" part

Always make these substitutions $\sqrt{-1}=i$ and $i^2=-1$

- To simplify: pull out the $\sqrt{-1}$ before performing any operation

**Example:** $\sqrt{-5}=\sqrt{-1}\cdot\sqrt{5}$ Pull out $\sqrt{-1}$
$= i\sqrt{5}$ Make substitution

Example: $(i\sqrt{5})^2 = i\sqrt{5}\cdot i\sqrt{5}$ List twice
$= i^2\sqrt{25}$ Simplify
$= (-1)(5) = -5$ Substitute

- Treat $i$ like any other variable when +, -, ×, or ÷ (but always simplify $i^2=-1$)

**Example:** $2i(3+i) = 2(3i)+2i(i)$ Distribute
$= 6i+2i^2$ Simplify
$= 6i+2(-1)$ Make substitution
$= -2+6i$ Simplify and rewrite in complex form

- Since $i=\sqrt{-1}$, no answer can have an '$i$' in the denominator **RATIONALIZE!!**

**Simplify.**

9. $\sqrt{-49}$

10. $6\sqrt{-12}$

11. $-6(2-8i)+3(5+7i)$

12. $(3-4i)^2$

13. $(6-4i)(6+4i)$

**Rationalize.**

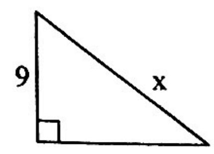
14. $\dfrac{1+6i}{5i}$

## Geometry:

Pythagorean Theorem (right triangles): $a^2 + b^2 = c^2$

**Find the value of x.**

15.

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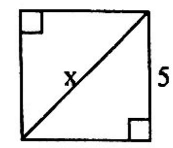


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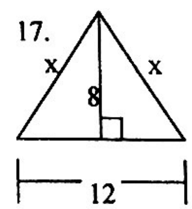
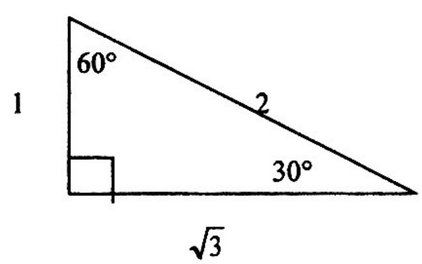
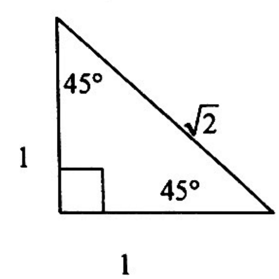



18. A square has perimeter 12 cm. Find the length of the diagonal.

* In $30° - 60° - 90°$ triangles, sides are in proportion $1, \sqrt{3}, 2$.

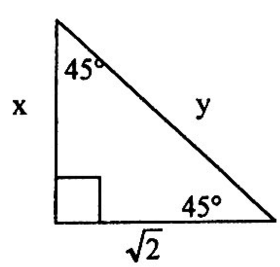



*In $45° - 45° - 90°$ triangles, sides are in proportion $1, 1, \sqrt{2}$.




**Solve for x and y.**

19.

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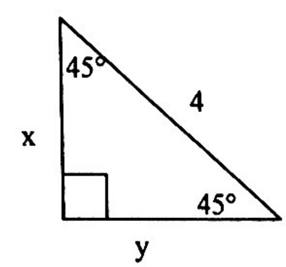
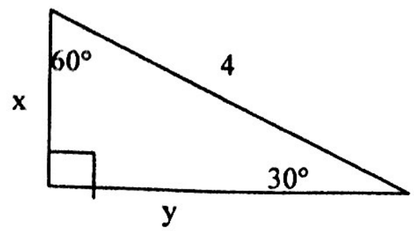
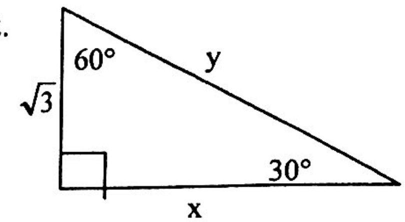


21. 


22. 


**Equations of Lines:**

| | |
|---|---|
| **Slope intercept form:** $y = mx + b$ | **Vertical line:** x = c (slope is undefined) |
| **Point-slope form:** $y - y_1 = m(x - x_1)$ | **Horizontal line:** y = c (slope is 0) |
| **Standard Form:** $Ax + By = C$ | **Slope:** $m = \frac{y_2 - y_1}{x_2 - x_1}$ |

23. State the slope and y-intercept of the linear equation: $5x - 4y = 8$.

24. Find the x-intercept and y-intercept of the equation: $2x - y = 5$

25. Write the equation in standard form: $y = 7x - 5$

**Write the equation of the line in slope-intercept form with the following conditions:**

26. slope = -5 and passes through the point (-3, -8)

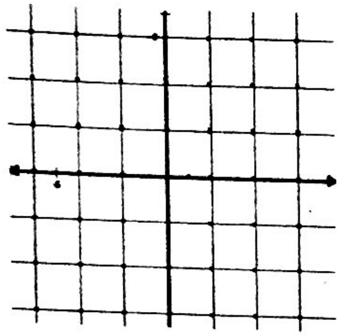
27. passes through the points (4, 3) and (7, -2)

28. x-intercept = 3 and y-intercept = 2

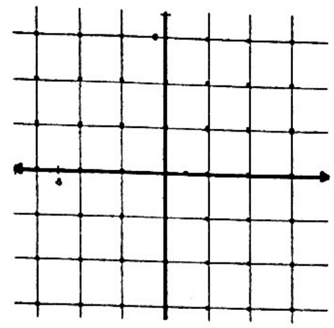
## Graphing:

**Graph each function, inequality, and / or system.**

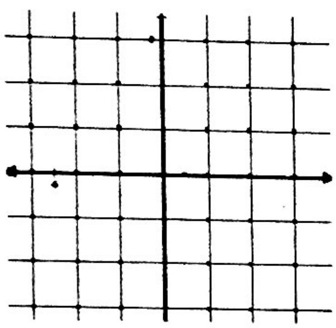
29. $3x-4y=12$



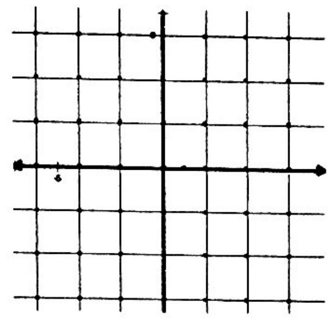
30. $\begin{cases} 2x+y=4 \\ x-y=2 \end{cases}$



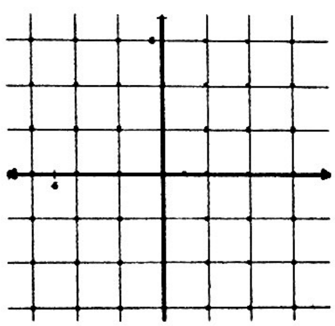
31. $y<-4x-2$



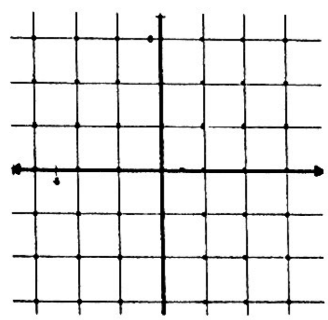
32. $y+2=|x+1|$



33. $y>|x|-1$



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



Vertex: ________________

x-intercept(s): ________________

y-intercept(s): ________________

## Systems of Equations:

$3x + y = 6$

$2x - 2y = 4$

**Substitution:**
Solve 1 equation for 1 variable.
Rearrange.
Plug into 2$^{nd}$ equation.
Solve for the other variable.

**Elimination:**
Find opposite coefficients for 1 variable.
Multiply equation(s) by constant(s).
Add equations together (lose 1 variable).
Solve for variable.

Then plug answer back into an original equation to solve for the 2$^{nd}$ variable.

| | |
|---|---|
| $y = 6 - 3x$ | solve 1$^{st}$ equation for y |
| $2x - 2(6 - 3x) = 4$ | plug into 2$^{nd}$ equation |
| $2x - 12 + 6x = 4$ | distribute |
| $8x = 16$ | simplify |
| $x = 2$ | |

| | |
|---|---|
| $6x + 2y = 12$ | multiply 1$^{st}$ equation by 2 |
| $2x - 2y = 4$ | coefficients of y are opposite |
| $8x = 16$ | add |
| $x = 2$ | simplify |

Plug $x = 2$ back into original

$3(2) + y = 6$

$6 + y = 6$

$y = 0$

**Solve each system of equations. Use any method.**

35. $\begin{cases} 2x + y = 4 \\ 3x + 2y = 1 \end{cases}$

36. $\begin{cases} 2x + y = 4 \\ 3x - y = 14 \end{cases}$

37. $\begin{cases} 2w - 5z = 13 \\ 6w + 3z = 10 \end{cases}$

**Exponents:**

**TWO RULES OF ONE**

1. $a^1 = a$

***Any number raised to the power of one equals itself.***

2. $1^a = 1$

***One to any power is one.***

**ZERO RULE**

3. $a^0 = 1$

***Any nonzero number raised to the power of zero is one.***

**PRODUCT RULE**

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

***When multiplying two powers that have the same base, add the exponents.***

**QUOTIENT RULE**

5. $\frac{a^m}{a^n} = a^{m-n}$

***When dividing two powers with the same base, subtract the exponents.***

**POWER RULE**

6. $(a^m)^n = a^{m \cdot n}$

***When a power is raised to another power, multiply the exponents.***

**NEGATIVE EXPONENTS**

7. $a^{-n} = \frac{1}{a^n}$ and $\frac{1}{a^{-n}} = a^n$

***Any nonzero number raised to a negative power equals its reciprocal raised to the opposite positive power.***

**Express each of the following in simplest form. Answers should not have any negative exponents.**

38. $5a^0$

39. $\frac{3c}{c^{-1}}$

40. $\frac{2ef^{-1}}{e^{-1}}$

41. $\frac{(n^3p^{-1})^2}{(np)^{-2}}$

**Simplify.**

42. $3m^2 \bullet 2m$

43. $(a^3)^2$

44. $(-b^3c^4)^5$

45. $4m(3a^2m)$

**Polynomials:**

To add / subtract polynomials, combine like terms.

EX: $8x-3y+6-(6y+4x-9)$ *Distribute the negative through the parantheses.*

$=8x-3y+6-6y-4x+9$ *Combine terms with similar variables.*

$=8x-4x-3y-6y+6+9$

$=4x-9y+15$

**Simplify.**

46. $3x^3+9+7x^2-x^3$

47. $7m-6-(2m+5)$

To multiplying two binomials, use FOIL.

EX: $(3x-2)(x+4)$ *Multiply the first, outer, inner, then last terms.*

$=3x^2+12x-2x-8$ *Combine like terms.*

$=3x^2+10x-8$

**Multiply.**

48. $(3a+1)(a-2)$

49. $(s+3)(s-3)$

50. $(c-5)^2$

51. $(5x+7y)(5x-7y)$

**Factoring.**

Follow these steps in order to factor polynomials.

**STEP 1:** Look for a GCF in ALL of the terms.

a.) If you have one (other than 1) factor it out front.
b.) If you don't have one, move on to STEP 2.

**STEP 2:** How many terms does the polynomial have?

**2 Terms**

a.) Is it difference of two squares? $a^2 - b^2 = (a+b)(a-b)$

**EX:** $x^2 - 25 = (x+5)(x-5)$

b.) Is it sum or difference of two cubes?

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

**EX:** $m^3 + 64 = (m+4)(m^2 - 4m + 16)$

$p^3 - 125 = (p-5)(p^2 + 5p + 25)$

**3 Terms**

$x^2 + bx + c = (x+ \quad)(x+ \quad)$ — **Ex:** $x^2 + 7x + 12 = (x+3)(x+4)$

$x^2 - bx + c = (x- \quad)(x- \quad)$ — $x^2 - 5x + 4 = (x-1)(x-4)$

$x^2 + bx - c = (x- \quad)(x+ \quad)$ — $x^2 + 6x - 16 = (x-2)(x+8)$

$x^2 - bx - c = (x- \quad)(x+ \quad)$ — $x^2 - 2x - 24 = (x-6)(x+4)$

**4 Terms** -- Factor by Grouping

a.) Pair up first two terms and last two terms
b.) Factor out GCF of each pair of numbers.
c.) Factor out front the parentheses that the terms have in common.
d.) Put leftover terms in parentheses.

Ex: $x^3 + 3x^2 + 9x + 27 = (x^3 + 3x^2) + (9x + 27)$

$$= x^2(x+3) + 9(x+3)$$
$$= (x+3)(x^2+9)$$

**Factor completely.**

52. $z^2 + 4z - 12$

53. $6 - 5x - x^2$

54. $2k^2 + 2k - 60$

55. $-10b^4 - 15b^2$

56. $9c^2 + 30c + 25$

57. $9n^2 - 4$

58. $27z^3 - 8$

59. $2mn - 2mt + 2sn - 2st$

**To solve quadratic equations, try to factor first and set each factor equal to zero. Solve for your variable. If the quadratic does NOT factor, use quadratic formula.**

**EX:** $x^2 - 4x = 21$ *Set equal to zero FIRST.*

$x^2 - 4x - 21 = 0$ *Now factor.*

$(x+3)(x-7) = 0$ *Set each factor equal to zero.*

$x + 3 = 0 \quad x - 7 = 0$ *Solve each for x.*

$x = -3 \quad x = 7$

**Solve each equation.**

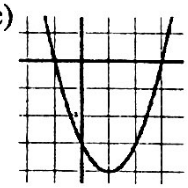
60. $x^2 - 4x - 12 = 0$

61. $x^2 + 25 = 10x$

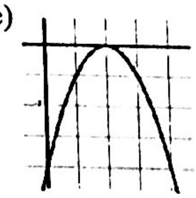
62. $x^2 - 14x + 40 = 0$

**DISCRIMINANT: The number under the radical in the quadratic formula $(b^2 - 4ac)$ can tell you what kinds of roots you will have.**

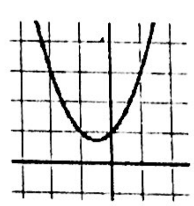
**IF $b^2 - 4ac > 0$ you will have TWO real roots.**
(touches x-axis twice)



**IF $b^2 - 4ac = 0$ you will have ONE real root**
(touches the x-axis once)



**IF $b^2 - 4ac < 0$ you will have TWO imaginary roots.**
(Graph does not cross the x-axis)



**QUADRATIC FORMULA – allows you to solve any quadratic for all its real and imaginary roots.** $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

**EX:** Solve the equation: $x^2 + 2x + 3 = 0$

$$Solve: \; x = \frac{-2 \pm \sqrt{-8}}{2}$$

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

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

**Solve each quadratic.**
**Use EXACT values.**

63. $x^2 - 9x + 14 = 0$

Roots = ____________________

64. $5x^2 - 2x + 4 = 0$

Roots = ____________________

## Composition and Inverses of Functions:

**Recall:** $(f \circ g)(x) = f(g(x))$ *OR* $f[g(x)]$ read "*f* of *g* of *x*" Means to plug the inside function (in this case g(x) ) in for x in the outside function (in this case, f(x)).

**Example:** Given $f(x) = 2x^2 + 1$ *and* $g(x) = x - 4$ find *f(g(x))*.

$$f(g(x)) = f(x-4)$$
$$= 2(x-4)^2 + 1$$
$$= 2(x^2 - 8x + 16) + 1$$
$$= 2x^2 - 16x + 32 + 1$$
$$f(g(x)) = 2x^2 - 16x + 33$$

**Suppose** $f(x) = 2x,\ g(x) = 3x - 2,$ *and* $h(x) = x^2 - 4$ **. Find the following:**

70. $f[g(2)] =$ ________

71. $f[g(x)] =$ ________

72. $f[h(3)] =$ ________

73. $g[f(x)] =$ ________

To find the inverse of a function, simply switch the x and the y and solve for the new "y" value.
**Example:**

| | |
|---|---|
| $f(x) = \sqrt[3]{x+1}$ | Rewrite f(x) as y |
| $y = \sqrt[3]{x+1}$ | Switch x and y |
| $x = \sqrt[3]{y+1}$ | Solve for your new y |
| $(x)^3 = (\sqrt[3]{y+1})^3$ | Cube both sides |
| $x^3 = y + 1$ | Simplify |
| $y = x^3 - 1$ | Solve for y |
| $f^{-1}(x) = x^3 - 1$ | Rewrite in inverse notation |

**Find the inverse,** $f^{-1}(x)$ **, if possible.**

74. $f(x) = 5x + 2$

75. $f(x) = \frac{1}{2}x - \frac{1}{3}$

## Rational Algebraic Expressions:

Multiplying and Dividing.

Factor numerator and denominator completely. Cancel any common factors in the top and bottom. If dividing, change divide to multiply and flip the second fraction.

EX:

$$\frac{x^2+10x+21}{5-4x-x^2} \bullet \frac{x^2+2x-15}{x^3+4x^2-21x}$$ *Factor everything completely.*

$$=\frac{(x+7)(x+3)}{(5+x)(1-x)} \bullet \frac{(x+5)(x-3)}{x(x-3)(x+7)}$$ *Cancel out common factors* in *the top and bottom.*

$$=\frac{(x+3)}{x(1-x)}$$ *Simplify.*

**Simplify.**

76. $\frac{5z^3+z^2-z}{3z}$

77. $\frac{m^2-25}{m^2+5m}$

78. $\frac{10r^5}{21s^2} \bullet \frac{3s}{5r^3}$

79. $\frac{a^2-5a+6}{a+4} \bullet \frac{3a+12}{a-2}$

80. $\frac{6d-9}{5d+1} \div \frac{6-13d+6d^2}{15d^2-7d-2}$

**Addition and Subtraction.**
First, find the least common denominator.
Write each fraction with the LCD.
Add / subtract numerators as indicated and leave the denominators as they are.

EX: $\frac{3x+1}{x^2+2x}+\frac{5x-4}{2x+4}$ *Factor denominator completely.*

$=\frac{3x+1}{x(x+2)}+\frac{5x-4}{2(x+2)}$ *Find LCD* $(2x)(x+2)$

$=\frac{2(3x+1)}{2x(x+2)}+\frac{x(5x-4)}{2x(x+2)}$ *Rewrite each fraction with the LCD as the denominator.*

$=\frac{6x+2+5x^2-4x}{2x(x+2)}$ *Write as one fraction.*

$=\frac{5x^2+2x+2}{2x(x+2)}$ *Combine like terms.*

81. $\frac{2x}{5}-\frac{x}{3}$

82. $\frac{b-a}{a^2b}+\frac{a+b}{ab^2}$

83. $\frac{2-a^2}{a^2+a}+\frac{3a+4}{3a+3}$

**Complex Fractions.**

Eliminate complex fractions by multiplying the numerator and denominator by the LCD of each of the small fractions. Then simplify as you did above

EX:

$$\frac{1+\frac{1}{a}}{\frac{2}{a^2}-1} \qquad \textit{Find LCD}: a^2$$

$$=\frac{\left(1+\frac{1}{a}\right)\cdot a^2}{\left(\frac{2}{a^2}-1\right)\cdot a^2} \qquad \textit{Multiply top and bottom by LCD.}$$

$$=\frac{a^2+a}{2-a^2} \qquad \textit{Factor and simplify if possible.}$$

$$=\frac{a(a+1)}{2-a^2}$$

84. $\dfrac{1-\frac{1}{2}}{2+\frac{1}{4}}$

85. $\dfrac{1+\frac{1}{z}}{z+1}$

86. $\dfrac{5+\frac{1}{m}-\frac{6}{m^2}}{\frac{2}{m}-\frac{2}{m^2}}$

87. $\dfrac{2+\frac{1}{x}-\frac{1}{x^2}}{1+\frac{4}{x}+\frac{3}{x^2}}$

**Solving Rational Equations:**

Multiply each term by the LCD of all the fractions. This should eliminate all of your fractions. Then solve the equation as usual.

$$\frac{5}{x+2}+\frac{1}{x}=\frac{5}{x}$$ *Find LCD first.* $x(x+2)$

$$x(x+2)\left(\frac{5}{x+2}\right)+x(x+2)\left(\frac{1}{x}\right)=\left(\frac{5}{x}\right)x(x+2)$$ *Multiply each term by the LCD.*

$$5x+1(x+2)=5(x+2)$$ *Simplify and solve.*

$$5x+x+2=5x+10$$

$$6x+2=5x+10$$

EX: $x=8$ $\Leftarrow$ *Check your answer. Sometimes they do not check!*

*Check:*

$$\frac{5}{8+2}+\frac{1}{8}=\frac{5}{8}$$

$$\frac{5}{10}+\frac{1}{8}=\frac{5}{8}$$

$$\frac{5}{8}=\frac{5}{8}$$

**Solve each equation. Check your solutions.**

88. $\frac{12}{x}+\frac{3}{4}=\frac{3}{2}$

89. $\frac{x+10}{x^2-2}=\frac{4}{x}$

90. $\frac{X}{5}=\frac{x}{x-5}-1$

## Logarithms

$y = \log_a x$ is equivalent to $x = a^y$

Product property: $\log_b mn = \log_b m + \log_b n$

Quotient property: $\log_b \frac{m}{n} = \log_b m - \log_b n$

Power property: $\log_b m^p = p \log_b m$

Property of equality: If $\log_b m = \log_b n$, then $m = n$

Change of base formula: $\log_a n = \frac{\log_b n}{\log_b a}$

**Solve each equation. Check your solutions.**

91. $2(3)^{2x} = 5$

92. $5\log(x-2) = 11$

93. $12 = 10^{x+5} - 7$

94. $\ln x + \ln(x-2) = 1$

95. $3 + \ln x = 8$

96. $3e^{-x} - 4 = 9$