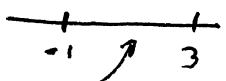
11) Identify the **vertex of the parabola** $y = -\frac{1}{2}(x+3)^2 + 4$

OPP SAME

$(-3, 4)$

12) Identify the **vertex of the parabola** $y = 2(x-3)(x+1)$



Avg $= \frac{-1+3}{2} = \frac{1}{=}$

IF $x = 1$

$y = 2(1-3)(1+1)$

$y = 2(-2)(2)$ $\quad y = -8$

$(1, -8)$

13) Identify the **vertex of the parabola** $y = x^2 - 6x + 11$

$x = \frac{-b}{2a} = \frac{-(-6)}{2(1)} = \frac{3}{=}$

IF $x = 3$

$y = (3)^2 - 6(3) + 11$

$y = 9 - 18 + 11$ $\quad y = \frac{2}{=}$

$(3, 2)$

14) Write the quadratic function $y = -(x+4)(x-9)$ in **standard form.**

$y = (-1)(x+4)(x-9)$

$y = (-1)(x^2 - 9x + 4x - 36)$

$y = (-1)(x^2 - 5x - 36)$

$y = -x^2 + 5x + 36$

15) Write the quadratic function $y = \frac{1}{2}(x+2)^2 - 3$ in **standard form.**

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

$y = \frac{1}{2}x^2 + 2x + 2 - 3$

$y = \frac{1}{2}x^2 + 2x - 1$

16) **Solve:** $8x^2 + 18x + 9 = 0$ by **factoring.**

$(4x+3)(2x+3) = 0$

$4x + 3 = 0$ $\quad 2x + 3 = 0$

$4x = -3$ $\quad 2x = -3$

$x_1 = -\frac{3}{4}$ $\quad x_2 = -\frac{3}{2}$

17) **Solve:** $\frac{1}{3}(x+5)^2 + 2 = 9$ by **extracting square roots.**

$\frac{1}{3}(x+5)^2 = 7$

$(x+5)^2 = 21$

$x + 5 = \pm\sqrt{21}$

$x = -5 \pm \sqrt{21}$

$x_1 = -5 - \sqrt{21}$

$x_2 = -5 + \sqrt{21}$

18) **Solve:** $2x^2 + x = 5$ by using the **quadratic formula.**

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

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-1 \pm \sqrt{(1)^2 - 4(2)(-5)}}{2(2)} = \frac{-1 \pm \sqrt{1+40}}{4} = \frac{-1 \pm \sqrt{41}}{4}$

$x_1 = \frac{-1 - \sqrt{41}}{4}$ $\quad x_2 = \frac{-1 + \sqrt{41}}{4}$

19) Given $x^2 - 8x + c$

A) Find the **value of *c* that makes the expression a perfect square trinomial.**

B) Then **write the expression as the square of a binomial.**

A) $\left(\frac{1}{2}(-8)\right)^2 = (-4)^2 = 16$ $\quad c = 16$

B) $x^2 - 8x + 16 = (x-4)^2$

20) Find the **zeros** of $f(x) = 4x^2 - 4x - 3 = 0$

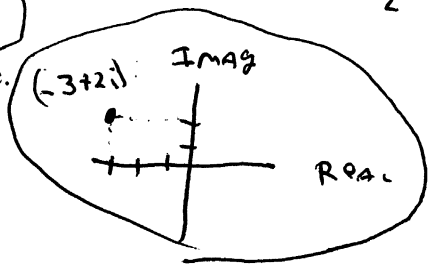
$(2x+1)(2x-3) = 0$

$2x+1=0$ $\quad 2x = -1$ $\quad x = -\frac{1}{2}$

$2x-3=0$ $\quad 2x = 3$ $\quad x = \frac{3}{2}$

ZEROS ARE $-\frac{1}{2}$ AND $\frac{3}{2}$

21) **Plot** $(-3+2i)$ in the complex plane.



22) Find the **absolute value** of $(-2-i)$

$z = a + bi$ $\quad z = -2 - 1i$

$|z| = \sqrt{a^2+b^2}$ $\quad |z| = \sqrt{(-2)^2 + (-1)^2} = \sqrt{4+1} = \sqrt{5}$

23) **Simplify** $(4+3i) - (-2+4i)$

$4 + 3i + 2 - 4i = 6 - i$

24) **Simplify** $4i(6-i)$ $\quad = 24i - 4i^2$

$= 24i + 4 = 4 + 24i$

25) **Simplify** $(-1+2i)(11-i)$ $\quad = (-1)(11) + (-1)(-i) + (2i)(11) + (2i)(-i)$

$= -11 + i + 22i - 2i^2$

$= -11 + 23i + 2 = -9 + 23i$

26) **Simplify** $\frac{3i}{(1+i)} \cdot \frac{(1-i)}{(1-i)}$ $\quad = \frac{3i - 3i^2}{1 - i^2} = \frac{3 + 3i}{1+1} = \frac{3+3i}{2}$

$= \frac{3}{2} + \frac{3}{2}i$

27) **Simplify** $\dfrac{(5+3i)}{(1-2i)}\dfrac{(1+2i)}{(1+2i)} = \dfrac{5+10i+3i+6i^2}{1-4i^2} = \dfrac{5+13i-6}{1+4}$

$= \dfrac{-1+13i}{5} = \boxed{-\frac{1}{5}+\frac{13}{5}i}$

28) **Simplify** $4\sqrt{-5}+3\sqrt{-125}$

$4i\sqrt{5}+3i\sqrt{125}$

$4i\sqrt{5}+15i\sqrt{5} = \boxed{19i\sqrt{5}}$

29) **Complete the square** in order to convert $y=x^2-8x+11$ into **vertex form.**

$y=(x^2-8x+\square)+11$

$y=(x^2-8x+16)+11-16$

$\boxed{y=(x-4)^2-5}$

30) **Complete the square** in order to convert $y=2x^2+6x+7$ into **vertex form.**

$y=2(x^2+3x+\square)+7$

$y=2\left(x^2+3x+\frac{9}{4}\right)+7-\frac{9}{2}$ (+9/2)

$\boxed{y=2\left(x+\frac{3}{2}\right)^2+\frac{5}{2}}$

31) Evaluate the **discriminant** of the following and then **describe solutions** (real/nonreal, different/same)

A) $x^2-4x+10=0$ $\quad b^2-4ac = 16-4(1)(10) = \boxed{-24}$ NONREAL DIFF

B) $x^2+3x-6=0$ $\quad b^2-4ac = 9-4(1)(-6) = \boxed{33}$ REAL DIFF

C) $x^2+14x+49=0$ $\quad b^2-4ac = 196-4(1)(49) = \boxed{0}$ REAL SAME

32) When an object is dropped, the model $h(t)=-16t^2+h_0$ describes the height (feet) of the object as a function of time (seconds). The initial height is represented by h_0.
If an object is dropped from a height of 320 feet, **in how many seconds will it hit the ground?**

$0=-16t^2+320$

$16t^2=320$

$t^2=\dfrac{320}{16}=20$

$t=\sqrt{20}=\sqrt{4}\sqrt{5}=\boxed{2\sqrt{5}\text{ sec}}$

33) Use the **quadratic formula to solve** $-x^2+2x=2$.

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

OR $x^2-2x+2=0$

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

$x=\dfrac{2\pm\sqrt{4-4(1)(2)}}{2(1)}=\dfrac{2\pm\sqrt{-4}}{2}=\dfrac{2\pm 2i}{2}$

$1\pm i$

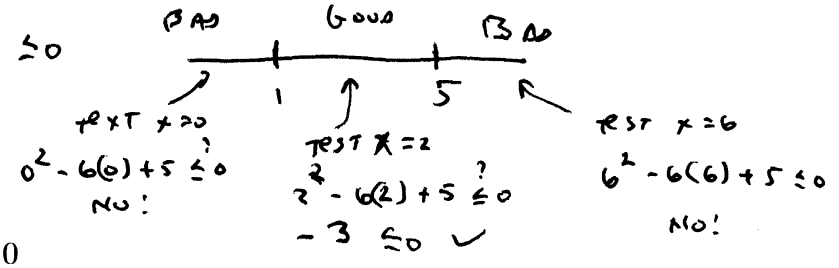
$x_1=1-i$

$x_2=1+i$

34) **Solve** the quadratic inequality $x^2 - 6x + 5 \le 0$

$(x-5)(x-1) \le 0$

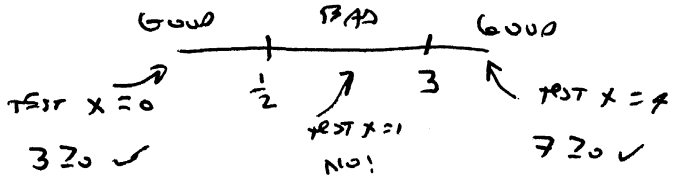
$1 \le x \le 5$



35) **Solve** the quadratic inequality $2x^2 - 7x + 3 \ge 0$

$(2x-1)(x-3) \ge 0$

$x \le \frac{1}{2}$ OR $x \ge 3$



36) **Write a quadratic function in vertex form** given vertex $(-1,4)$ and point $(-2,2)$

$y = a(x+1)^2 + 4$

$(-2,2)$ $2 = a(-2+1)^2 + 4$ $\quad 2 = a(1) + 4$

$a = -2$

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

37) **Write a quadratic function in intercept form** given x-intercepts -2 & 1 and point $(-1,-6)$

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

$(-1,-6)$ $-6 = a(-1+2)(-1-1)$

$-6 = a(1)(-2)$ $\quad a = \frac{-6}{-2} = 3$

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

38) **Write a quadratic form in standard form** given points $(0,-4)$, $(-1,-5)$, $(2,10)$

$y = ax^2 + bx - 4$

$(-1,-5)$ $-5 = a(-1)^2 + b(-1) - 4 \Rightarrow a - b = -1 \Rightarrow a - b = -1$

$(2,10)$ $10 = a(2)^2 + b(2) - 4 \Rightarrow 4a + 2b = 14 \Rightarrow 2a + b = 7$

$3a = 6$ $\quad a = 2$ $\quad b = 3$

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

39) **Expand** $(x+y)^2$

$(x+y)(x+y) = x^2 + 2xy + y^2$

40) **Factor completely**: $x^2 - 12x - 28$

$(x+2)(x-14)$

41) **Factor completely**: $4x^2 - 4x - 3$

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

42) **Factor completely:** $9x^2 + 24x + 16$ $(3x+4)^2$

43) **Factor completely:** $6x^2 + 15x + 9$

$3(2x^2 + 5x + 3) = 3(2x+3)(x+1)$

44) **Factor completely:** $2x^2 + 54 = 2(x^2 + 27)$

45) **Factor completely:** $x^3 - 1 = (x)^3 - (1)^3 = (x-1)(x^2 + x + 1)$

46) **Factor completely:** $-2x^3 - 4x^2 - 3x - 6 = -2x^2(x+2) - 3(x+2)$

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

47) **Factor completely:** $81x^4 - 16$

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

$(3x-2)(3x+2)(9x^2+4)$

48) **Evaluate** 2^{10} (hint: use fingers and count to 10 as you keep doubling—2, 4, 8, 16, etc.)

1024

49) **Simplify** $x^2 \cdot x^{-2} = x^0 = 1$

50) **Evaluate** $-2^2 = -4$

51) **Evaluate** $(-2)^2$ $= (-2)(-2) = 4$

52) **Evaluate** 2^{-2} $= \frac{1}{2^2} = \frac{1}{4}$

53) **Evaluate** $(-5)^{-6}(-5)^4$ $= (-5)^{-2} = \frac{1}{(-5)^2} = \frac{1}{25}$

54) **Evaluate** $-4^{-2} + \frac{1}{3^{-2}}$ $-\frac{1}{16} + 9 = \frac{144}{16} - \frac{1}{16} = \frac{143}{16}$ OR $8\frac{15}{16}$

55) **Evaluate** $\left(2^3\right)^2$ $2^6 = 64$

56) **Evaluate** $\left(\frac{2}{3}\right)^{-4}$ $= \left(\frac{3}{2}\right)^4 = \frac{3^4}{2^4} = \frac{81}{16}$

57) **Simplify** $(-3x)^3$ $= (-3)(-3)(-3)\,x\,x\,x = -27x^3$

58) **Simplify** $\left(\frac{xy^9}{20x^2y^{-2}}\right)\left(\frac{-7y}{21x^5}\right)$ $= \frac{-7xy^{10}}{(20)(21)\,x^7y^{-2}} = \frac{-xy^{10}}{60x^{7}(y^{-2})} = \frac{-y^{12}}{60x^6}$

3

59) **Simplify** $\dfrac{(m^4 w)^2}{m^0 + w^0}$

$\dfrac{m^8 w^2}{1+1} = \dfrac{m^8 w^2}{2}$

60) **Subtract** $(8x^3 - 3x^2 - 2x + 9) - (6x^2 - x + 1)$

$8x^3 - 3x^2 - 2x + 9 - 6x^2 + x - 1$

$8x^3 - 9x^2 - x + 8$

61) **Multiply** $(x+5)(5x^2 + 3x - 1)$

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

$25x^2 + 15x - 5$

$5x^3 + 28x^2 + 14x - 5$

62) **Multiply** $(x-2)(x-1)(x+3)$

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

$x^3 + 2x^2 - 3x$

$-2x^2 - 4x + 6$

$x^3 - 7x + 6$

63) **Solve** $3x^4 + 3x^3 - 6x^2 - 6x = 0$

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

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

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

$x_1 = 0 \quad x_2 = -1 \quad x_3 = -\sqrt{2} \quad x_4 = \sqrt{2}$

64) **Divide** $(x^3 - 3x^2 - 7x + 6)$ by $(x-4)$

4	1	−3	−7	6
		4	4	−12
	1	1	−3	−6

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

65) **Divide** $(x^3 - 3x^2 - 7x + 6)$ by $(x+2)$

−2	1	−3	−7	6
		−2	10	−6
	1	−5	3	0

$x^2 - 5x + 3$

66) **Factor** $f(x) = 3x^3 + 13x^2 + 2x - 8$ given that $f(-4) = 0$ $(x+4)$ IS A FACTOR

−4	3	13	2	−8
		−12	−4	8
	3	1	−2	0

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

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

67) **List all the possible rational zeros** of $f(x) = 4x^3 + 5x^2 - 3$

C: $\pm 1, 3$

L: $\pm 1, 2, 4$

Possible: $\frac{C}{L} = \left\{\pm 1, \frac{1}{2}, \frac{1}{4}, 3, \frac{3}{2}, \frac{3}{4}\right\}$

68) **State the degree** of the following polynomial: $f(x) = 2(x+3)(x-2)^3(x+1)^2$

$1 + 3 + 2 =$ 6TH DEGREE

69) A third degree polynomial function has zeros of 3 and $(2-4i)$.

List the other zero. $2 + 4i$

70) **Write a polynomial function of least degree** that has a lead coefficient of 1, real coefficients, and zeros of 4 and $5i$. $-5i$

$f(x) = (x-4)(x-5i)(x+5i)$

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

$= (x-4)(x^2+25)$

$x^3 + 25x - 4x^2 - 100$

$f(x) = x^3 - 4x^2 + 25x - 100$

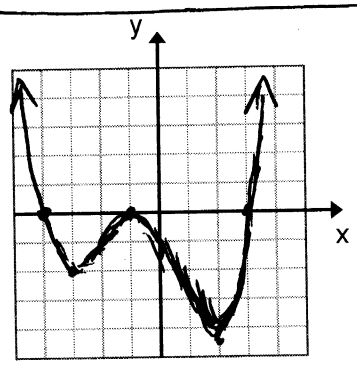
71) **Draw a rough sketch** of the polynomial function

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

"CUP" "BOWL" "CUP"

4TH DEGREE WITH 3 X-INT (3 TURNING POINTS)

END BEHAVIOR LIKE $y = +x^4$ ↑ ↑



DO NOT NEED TO PLOT LOT OF POINTS ROUGH SKETCH ONLY!

NEED TO SHOW:

1) GOOD END BEHAVIOR
2) X-INT
3) "CUTS" THROUGH X-AXIS AT $-4, 3$
4) "BOWL" AT -1

72) The graph of a cubic polynomial function has x-intercepts of -3, 2, and 5.

The graph also passes through the point $(0, -15)$.

Write the cubic polynomial function in intercept form.

$y = a(x+3)(x-2)(x-5)$

$(0, -15)$ $-15 = a(0+3)(0-2)(0-5)$

$-15 = a(3)(-2)(-5)$

$-15 = 30a$

$a = \frac{-15}{30} = -\frac{1}{2}$

$y = -\frac{1}{2}(x+3)(x-2)(x-5)$

73) **Simplify** $9^{3/2}$

$= (9^{1/2})^3 = 3^3 =$ 27

74) **Simplify** $32^{-2/5}$ $= \frac{1}{32^{2/5}} = \frac{1}{(32^{1/5})^2} = \frac{1}{2^2} = \frac{1}{4}$

75) **Simplify** $5^{1/2} \cdot 5^{1/4}$ $= 5^{\frac{1}{2}+\frac{1}{4}} = 5^{3/4}$

76) **Simplify** $\sqrt[3]{54}$ $= \sqrt[3]{3 \cdot 3 \cdot 3 \cdot 2} = 3\sqrt[3]{2}$

77) **Simplify** $\sqrt[5]{\frac{3}{4}}$ $= \frac{\sqrt[5]{3}}{\sqrt[5]{2 \cdot 2}} \frac{\sqrt[5]{2 \cdot 2 \cdot 2}}{\sqrt[5]{2 \cdot 2 \cdot 2}} = \frac{\sqrt[5]{24}}{2}$

78) **Simplify** $\sqrt[3]{125y^6}$ (assume all variables are positive)

$5 \cdot 5 \cdot 5 \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y$ $= 5y^2$

79) **Simplify** $\sqrt[5]{5a^5b^9c^{13}}$ (assume all variables are positive)

a: $5 \div 5 = 1$ R0

b: $9 \div 5 = 1$ R4

c: $13 \div 5 = 2$ R3

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

80) **Simplify** $3\sqrt[3]{5x^5} - x\sqrt[3]{40x^2}$ (assume all variables are positive)

$3x\sqrt[3]{5x^2} - 2x\sqrt[3]{5x^2}$

$= x\sqrt[3]{5x^2}$

$40 = 2 \cdot 2 \cdot 2 \cdot 5$ $= 2\sqrt[3]{5}$

81) **Simplify** $\sqrt{8} + \sqrt{75} + \sqrt{50}$

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

$= 7\sqrt{2} + 5\sqrt{3}$

$75 = 5 \cdot 5 \cdot 3$ $50 = 5 \cdot 5 \cdot 2$

82) **Expand** $\left(2+\sqrt{3}\right)^2$ $(2+\sqrt{3})(2+\sqrt{3})$

$4+2\sqrt{3}+2\sqrt{3}+3 = 7+4\sqrt{3}$

83) **Multiply** $\left(2-\sqrt{3}\right)\left(3+2\sqrt{2}\right)$ $= 6+4\sqrt{2}-3\sqrt{3}-2\sqrt{6}$

84) **Simplify** $\frac{1}{\sqrt{2}}\ \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

85) **Simplify** $\frac{3}{(2+\sqrt{5})}\ \frac{(2-\sqrt{5})}{(2-\sqrt{5})} = \frac{6-3\sqrt{5}}{4-5} = \frac{6-3\sqrt{5}}{-1}$

$= 6+3\sqrt{5}$

86) Let $f(x)=x^2-1$ $g(x)=3x$

A) **Find the composition** $f(g(x))$ $= f(3x) = (3x)^2-1 = 9x^2-1$

B) **Find the composition** $g(f(x))$ $= g(x^2-1) = 3(x^2-1) = 3x^2-3$

87) If $f(x)=\frac{1}{6}x^5+\frac{2}{3}$, **find the inverse** $f^{-1}(x)$.

$y = \frac{1}{6}x^5+\frac{2}{3}$

$x = \frac{1}{6}y^5+\frac{2}{3}$

$\frac{1}{6}y^5 = x-\frac{2}{3}$

$y^5 = 6x-4$

$y = \sqrt[5]{6x-4}$

OR $f^{-1}(x) = \sqrt[5]{6x-4}$

88) **Solve** $\sqrt[3]{x}-4=0$

$\sqrt[3]{x} = 4$

$x = 4^3$

$x = 64$

89) **Solve** $2x^{3/2} = 250$

$x^{3/2} = 125$

$x = (125)^{2/3} = 5^2 = 25$

90) **Solve** $\sqrt{4x-7}+2=5$

$\sqrt{4x-7} = 3$

$4x-7 = 9$

$4x = 16$

$x = 4$

check: $\sqrt{4(4)-7}+2 \stackrel{?}{=} 5$

$\sqrt{9}+2 \stackrel{?}{=} 5$

$3+2=5$

$5=5$ ✓

91) **Solve** $\sqrt{3x+2}-2\sqrt{x}=0$

$\sqrt{3x+2} = 2\sqrt{x}$

$3x+2 = 4x$

$-3x \quad -3x$

$x = 2$

check: $\sqrt{3(2)+2} - 2\sqrt{2} \stackrel{?}{=} 0$

$\sqrt{6} - 2\sqrt{2} \stackrel{?}{=} 0$

$2\sqrt{2} - 2\sqrt{2} = 0$

$0 = 0$ ✓

92) **Solve** $x-4=\sqrt{2x}$

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

$x^2 - 8x + 16 = 2x$

$x^2 - 10x + 16 = 0$

$(x-8)(x-2) = 0$

$x_1 = 8$

check: $8-4 \stackrel{?}{=} \sqrt{2(8)}$

$4 \stackrel{?}{=} 4$

check ✓

$x_2 \neq 2$

check: $2-4 \stackrel{?}{=} \sqrt{2(2)}$

$-2 = 2$

NO!

93) **Simplify and write in radical form:** $5x^{1/2}y^{5/3}$ (assume all variables are positive)

$5\sqrt{x}\, y \sqrt[3]{y^2} = 5y\sqrt{x}\sqrt[3]{y^2}$

94) **Simplify and write using rational exponents:** $\sqrt[3]{27x^4y^2}$ (assume all variables are positive)

$= 3x\sqrt[3]{xy^2} = 3x \cdot x^{1/3} \cdot y^{2/3}$

95) State the **domain and range** of $y = \ln(x-2)+5$

Domain: $x > 2$

Range: $\mathbb{R}$

NOTE: $\mathbb{R}$ is symbol for all real numbers

96) State the **domain and range** of $y = 3^{x-2} + 1$

Domain: $\mathbb{R}$

Range: $y > 1$

97) A town has a population of 75,000 and the population increases 2% every year.
Write an **exponential growth model**.

$y = 75{,}000\,(1.02)^x$

98) You purchase a car for $25,000 and the value decreases 15% every year.
Write an **exponential decay model**.

$y = 25{,}000\,(.85)^x$

99) **Just set up the equation for the following—do not evaluate.**
You deposit $500 in a bank that pays 0.8% annual interest, compounded quarterly. How much money will you have in 10 years?

P, $r = .008$, $n = 4$, $t = 10$

$A = P\left(1 + \frac{r}{n}\right)^{nt}$

$A = 500\left(1 + \frac{.008}{4}\right)^{(4)(10)}$

100) **Just set up the equation for the following—do not evaluate.**
You deposit $1000 in a bank that pays 2.5% annual interest, compounded continuously.
How much money will you have in 20 years?

$A = Pe^{rt}$

$A = 1000\,e^{(.025)(20)}$

101) **Simplify** $\sqrt{\frac{9e^6}{4\left(27q^{18}x\right)}x^3}$

$= \sqrt{4 \cdot 9\, e^6 x^4}$

$= \sqrt{36\, e^6 x^4}$

$= 6e^3 x^2$

102) **Evaluate** $\log_2(64) = ?$

$2^{?} = 64$

$? = 6$

103) **Evaluate** $\log_9 27 = ?$

$9^{?} = 27$

$(3^2)^{?} = 3^3$

$3^{2?} = 3^3$

$2? = 3$

$? = \frac{3}{2}$

104) **Simplify** $\log_5 125^x = ?$

$5^{?} = 125^x$

$5^{?} = (5^3)^x$

$5^{?} = 5^{3x}$

$? = 3x$

105) Find the **inverse** of $y = e^{x+2} - 5$

$x = e^{y+2} - 5$

$e^{y+2} = x + 5$

$y + 2 = \ln(x+5)$

$y = \ln(x+5) - 2$

$f^{-1}(x) = \ln(x+5) - 2$

106) Use $\log_5(2) \approx 0.4$ and $\log_5(3) \approx 0.7$ to **approximate** $\log_5\left(\frac{3}{2}\right)$.

$\log_5\left(\frac{3}{2}\right) = \log_5(3) - \log_5(2)$

$= .7 - .4$

$= .3$

107) **Condense** $\ln 40 + 2\ln\frac{1}{2} + \ln x$

$\ln 40 + \ln\left(\frac{1}{2}\right)^2 + \ln x$

$\ln 40 + \ln\left(\frac{1}{4}\right) + \ln x$

$\ln(40 \cdot \frac{1}{4} \cdot x)$

$= \ln(10x)$

108) **Expand** $\log_4\left(\frac{x^2}{3y}\right)$

$= \log_4(x^2) - [\log_4(3y)]$

$= 2\log_4(x) - [\log_4(3) + \log_4(y)]$

$= 2\log_4(x) - \log_4(3) - \log_4(y)$

109) Use the **change of base formula** to express $\log_3 7$ **in terms of common logarithms.**

$$\log_3 7 = \frac{\log 7}{\log 3}$$

110) **Solve** $4^x = \left(\frac{1}{2}\right)^{x-3}$

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

$$2^{2x} = 2^{-x+3}$$

$$2x = -x+3$$

$$3x = 3$$

$$x = 1$$

111) **Solve** $4\ln(-x)+3=21$

$$4\ln(-x) = 18$$

$$\ln(-x) = \frac{18}{4} = \frac{9}{2}$$

$$-x = e^{9/2}$$

$$x = -e^{9/2}$$

112) **Solve** $4^x = 11$ and report answer in terms of natural logs.

$$\ln 4^x = \ln 11$$

$$x \ln 4 = \ln 11$$

$$x = \frac{\ln 11}{\ln 4}$$

113) You take soup off the stove at 200 deg F. (T_0) The kitchen is at 75 deg F. (T_R)

The cooling rate of the soup is $r = \frac{0.05}{\text{min}}$.

In how many minutes ($t = ?$) will it take the soup to cool to 100 deg F? (T)

NEWTON'S LAW OF COOLING:

$$T = (T_0 - T_R)e^{-rt} + T_R$$

$$100 = (200-75)e^{-.05t} + 75$$

$$25 = 125e^{-.05t}$$

$$e^{-.05t} = \frac{25}{125} = \frac{1}{5}$$

$$-.05t = \ln\left(\frac{1}{5}\right)$$

$$* \quad t = \frac{\ln \frac{1}{5}}{-.05} \text{ MINUTES}$$

or $t = -20\ln\frac{1}{5} = -20\ln(5^{-1})$

or $t = 20\ln 5$

114) Write an **exponential function** whose graph passes through $(3,18)$ and $(1,2)$.

$y = ab^x$

$(3,18)$ $18 = ab^3$

$(1,2)$ $2 = ab^1$

$9 = b^2$

$b = 3$

$2 = a(3)^1$

$a = \frac{2}{3}$

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

115) Write a **power function** whose graph passes through $(2,16)$ and $(1,4)$.

$y = ax^b$

$(2,16)$ $16 = a2^b$

$(1,4)$ $4 = a1^b$

$4 = 2^b$ $\quad b = 2$

$4 = a \cdot 1^2$

$a = 4$

$y = 4 \cdot x^2$

116) The intensity of light **varies inversely** as the square of the observers distance from the light source. The light intensity is 9 lumens when the observer is 10 meters from the light source. If the observer is 3 meters from the light source, **what is the light intensity**?

$I = \frac{k}{d^2}$ $\quad 9 = \frac{k}{10^2}$ $\quad k = 900$

$I = \frac{900}{d^2}$ $\quad I = \frac{900}{3^2} = \frac{900}{9}$

$I = 100$ LUMENS

117) State the **domain and range** of $y = \frac{2}{x+3} - 4$

DOMAIN: $\mathbb{R}$ except -3

RANGE: $\mathbb{R}$ except -4

118) Given $y = \frac{3x^2 + 10x - 8}{x^2 - 4}$, find the following:

$(x+2)(x-2)$

A) **Vertical Asymptotes** $x = -2$ $\quad x = 2$

B) **Horizontal Asymptote** $\frac{3x^2}{1x^2} = 3$ $\quad y = 3$

119) Given $y = \dfrac{x^2 - 2x - 3}{x - 4}$, find the following:

A) **Vertical Asymptote** $x = 4$

B) **Slant Asymptote**

$$x-4 \;\overline{)\; x^2 - 2x - 3}$$

$x + 2$ with remainder 5

$y = x + 2$

Reciprocate

120) **Simplify** $\dfrac{x^2 - x - 12}{8x^2} \div \dfrac{x^3 + 3x^2}{8x^3 - 2x^2} \cdot \dfrac{x+2}{4x-1}$

$$\frac{(x-4)(x+3)}{8x^2} \cdot \frac{x^2(4x-1)}{x^2(x+3)} \cdot \frac{(x+2)}{(4x-1)} = \frac{(x-4)(x+2)}{4x^2}$$

121) **Add** $\dfrac{3}{x} + \dfrac{5}{x-2}$

$$\frac{3(x-2)}{x(x-2)} + \frac{5x}{x(x-2)}$$

$$= \frac{3x - 6 + 5x}{x(x-2)} = \frac{8x-6}{x(x-2)} \text{ OR } = \frac{2(4x-3)}{x(x-2)}$$

122) **Simplify:** $\dfrac{\frac{x}{5} + 4}{8 + \frac{1}{x}}$

$$= \frac{\frac{x}{5} + \frac{4}{1}}{\frac{8}{1} + \frac{1}{x}} = \frac{\frac{x}{5} + \frac{20}{5}}{\frac{8x}{x} + \frac{1}{x}} = \frac{\frac{x+20}{5}}{\frac{8x+1}{x}}$$

$$= \frac{x+20}{5} \cdot \frac{x}{8x+1} = \frac{x(x+20)}{5(8x+1)}$$

123) **Solve:** $\dfrac{2x}{x-1} + \dfrac{1}{x-3} = \dfrac{2}{x^2 - 4x + 3}$

$x \neq 1$
$x \neq 3$

$$\frac{2x}{x-1} + \frac{1}{x-3} = \frac{2}{(x-3)(x-1)}$$

MULT EACH TERM BY LCM OF DENOM

$$\frac{2x(x-1)(x-3)}{(x-1)} + \frac{1(x-1)(x-3)}{(x-3)} = \frac{2(x-1)(x-3)}{(x-3)(x-1)}$$

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

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

$$2x^2 - 5x - 3 = 0$$

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

$x_1 = -\frac{1}{2}$ $\quad x_2 \neq 3$

$x = -\frac{1}{2}$