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Calculus AB Summer Assignment Key

$$1. \begin{aligned} g(x-1) &= 2(x-1) + 5 = 2x + 3 \\ f(g(x-1)) &= (2x+3)^2 = \boxed{4x^2 + 12x + 9} \end{aligned}$$

$$2. \begin{aligned} h(x^3) &= (x^3)^2 - 1 = x^6 - 1 \\ g(h(x^3)) &= 2(x^6 - 1) + 5 = \boxed{2x^6 + 3} \end{aligned}$$

$$3. \begin{aligned} f(a+h) &= (a+h)^2 = a^2 + 2ah + h^2 \\ g(f(a+h)) &= 2(a^2 + 2ah + h^2) + 5 = \boxed{2a^2 + 4ah + 2h^2 + 5} \end{aligned}$$

$$4. \frac{g(x+h) + 3 - (9x+3)}{h} = \frac{9x+9h+3-9x-3}{h} = \frac{9h}{h} = \boxed{9}$$

$$5. \frac{(x+h)^2 - 10 - (x^2 - 10)}{h} = \frac{x^2 + 2xh + h^2 - 10 - x^2 + 10}{h} = \boxed{2x+h}$$

$$6. \frac{(x+h)^2 - 3(x+h) + 2 - (x^2 - 3x + 2)}{h} = \frac{x^2 + 2xh + h^2 - 3x - 3h + 2 - x^2 + 3x - 2}{h} = \frac{2xh + h^2 - 3h}{h} = \boxed{2x - 3 + h}$$

$$7. \text{ x-int(s): } 0 = x\sqrt{16-x^2} \\ \boxed{\text{at } x=0, \pm 4}$$

$$\text{ y-int(s): } y = 0\sqrt{16-0} \\ \boxed{\text{at } y=0}$$

$$8. \text{ x-int(s): } 0 = x^2(x-1)^2 \\ \boxed{\text{at } x=0, 1}$$

$$\text{ y-int(s): } y = 0^2(0-1)^2 \\ \boxed{\text{at } y=0}$$

$$9. \text{ x-int(s): } x - \frac{1}{2} = 0 \\ \boxed{\text{at } x = \frac{1}{2}}$$

$$\text{ y-int(s): } y = -\frac{1}{2} \\ \boxed{\text{at } y = -\frac{1}{4} \cdot 2}$$

$$10. \begin{aligned} D: & (-\infty, \infty) \\ R: & [-5, \infty) \end{aligned}$$

$$11. \begin{aligned} D: & [-3, \infty) \\ R: & (-\infty, 0] \end{aligned}$$

$$12. \begin{cases} D: (-\infty, \infty) \\ R: [-3, 3] \end{cases}$$

Amplitude = 3

$$13. \begin{cases} D: (-\infty, -3) \cup (-3, 3) \cup (3, \infty) \\ R: (-\infty, 0) \cup (0, \infty) \end{cases} \begin{cases} \text{V.A. @ } x = -3, 3 \\ \text{H.A. @ } y = 0 \end{cases}$$

$$14. x^2 - x - 6 = 0 \quad (x-3)(x+2) = 0$$

$x = 3, -2 \rightarrow \text{Vert. Asy.}$

$$\begin{cases} D: (-\infty, -2) \cup (-2, 3) \cup (3, \infty) \\ R: (-\infty, 0) \cup (0, \infty) \end{cases}$$

$$15. \begin{cases} D: (-\infty, \infty) \\ R: [0, 3] \end{cases}$$

H.A @ $y = 3$, can't get a neg.

$$16. \begin{cases} D: (-\infty, 1) \cup (1, \infty) \\ R: (-\infty, 0) \cup (0, \infty) \end{cases} \begin{cases} \text{V.A. @ } x = 1 \\ \text{H.A. @ } y = 0 \end{cases}$$

$$17. \boxed{y = 3x + 5}$$

$$18. \boxed{y - 5 = \frac{2}{3}(x - 0) \quad \text{or} \quad y = \frac{2}{3}x + 5}$$

$$19. m = -1 \quad \boxed{y - 2 = -1(x - 1) \quad \text{or} \quad y = -x + 3}$$

$$20. m = 0 \Rightarrow \text{horizontal line} \quad \boxed{y = 2}$$

$$21. \boxed{x = -4}$$

$$22. \boxed{y - 8 = \frac{5}{6}(x - 2) \quad \text{or} \quad y = \frac{5}{6}x + \frac{19}{3}}$$

$$23. \boxed{y + 3 = -\frac{6}{5}(x - 2) \quad \text{or} \quad y = -\frac{6}{5}x - \frac{3}{5}}$$

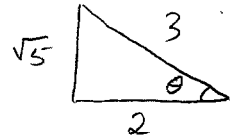
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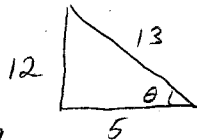
24. $\tan(\arccos \frac{2}{3})$

$\cos^{-1}(\frac{2}{3}) = \theta \Rightarrow \frac{2}{3} = \cos \theta$

$\tan \theta = \frac{\sqrt{5}}{2}$



25. $\sec(\sin^{-1} \frac{12}{13})$



$\cos \theta = \frac{5}{13}$

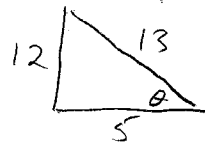
$\sec \theta = \frac{13}{5}$

26. $\sin(\arctan \frac{12}{5})$

$\tan^{-1} \frac{12}{5} = \theta$

$\tan \theta = \frac{12}{5}$

$\sin(\arctan \frac{12}{5}) = \frac{12}{13}$



27. $\sin(\sin^{-1} \frac{7}{8}) = \frac{7}{8}$

28. V.A.: $x = 0$

29. V.A.: $x^2 - 4 = 0$

$x = 2, -2$

30. V.A.: $x = 0, 1$

31. $y = 0$

32. $y = -\frac{5}{3}$

33. no horizontal Asymptote

34. $x^2 - 6x + 5 = 0$

$(x-5)(x-1) = 0$

$x = 1, 5$

35. $3x^3 - 4x - 1 = 0$

$\frac{p}{q} : \pm 1, \pm \frac{1}{3}$

$$\begin{array}{r} -1 \ 3 \ 0 \ -4 \ -1 \\ \underline{3 \ -3 \ -1 \ 0} \end{array}$$

$f(1) = 3 - 4 - 1 = -2$

$3x^2 - 3x - 1 = 0$

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

$$\frac{3 \pm \sqrt{9 - 4(3)(-1)}}{6} = \frac{3 \pm \sqrt{21}}{6}$$

$\therefore x+1$ is a factor

$$\left[-1, \frac{3 + \sqrt{21}}{6}, \frac{3 - \sqrt{21}}{6} \right]$$

$$36. 2e^{-t} - 2te^{-t} = 0$$

$$2e^{-t}(1-t) = 0$$

$$\frac{2}{e^t} = 0$$

$$1-t = 0$$

$$\boxed{t=1}$$

$$37. \sin^2 x - \sin x = 0$$

$$\sin x (\sin x - 1) = 0$$

$$\sin x = 0 \quad \sin x = 1$$

$$\boxed{x = 0, \frac{\pi}{2}, \pi}$$

$$38. \frac{x^2 - a^2}{(x^2 - a^2)(x^2 + a^2)} = \boxed{\frac{1}{x^2 + a^2}}$$

$$39. \sqrt{x}(x-1)^2 = x^{1/2}(x^2 - 2x + 1) = \boxed{x^{5/2} - 2x^{3/2} + x^{1/2}}$$

$$40. \frac{x+h}{x+h+2} - \frac{x}{2x} = \frac{2x+2h-1}{2(x+h+2)} \cdot \frac{1}{h} = \boxed{\frac{2x+2h-1}{2h(x+h+2)}}$$

$$41. \frac{x^2 - (x^2 + 2xh + h^2)}{x^2(x+h)^2} \cdot \frac{1}{h} = \frac{-2xh - h^2}{x^2h(x+h)^2}$$

$$= \boxed{\frac{-(2x+h)}{x^2(x+h)^2}}$$

$$42. \frac{y+x}{xy} \cdot \frac{1}{(x+y)} = \boxed{\frac{1}{xy}}$$

$$43. \left(\frac{1}{x} + \frac{1}{y}\right)^{-1} = \left(\frac{y+x}{xy}\right)^{-1} = \boxed{\frac{xy}{x+y}}$$

$$44. \frac{(x-4)(x+2)}{x(x^2+x-2)} = \frac{(x-4)(x+2)}{x(x+2)(x-1)} = \boxed{\frac{x-4}{x(x-1)}}$$

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45. $8a^6b^{-1}$

46. $\frac{2a}{b} \cdot \frac{a}{3} = \frac{2a^2b^{-1}}{3} = \frac{2a^2b^{-1}}{3}$

47. $\frac{a(b-1)}{b(b-1)} = \frac{a}{b} = ab^{-1}$

48. $\frac{b}{a \cdot a^{1/2}} = \frac{b}{a^{3/2}} = ba^{-3/2}$

49. $\frac{a^{4/3}}{b^1} \cdot \frac{b^{-3/2}}{a^{1/2}} = a^{5/6}b^{1/2}$

50. $z(3xy^2 + 2x^2y) = -y^3 - 2xy^2$

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

51. $z(1 - \sin y) = 1$ $z = \frac{1}{1 - \sin y}$

52. $e^{2y} = 2(x^3 + 2)$
 $2y = \ln(2(x^3 + 2))$

$y = \frac{\ln(2(x^3 + 2))}{2}$

53. $f(k) - f(-3) = 0$
 $\frac{1}{3}k^3 - \frac{1}{3}(-3)^3 = 0$

$k^3 + 27 = 0$

$k = -3$

54. minimum value of a parabola opening up is vertex.

$$x = \frac{-b}{2a} = \frac{6}{6} = 1 \quad f(1) = 3 - 6 + 12 = \boxed{9}$$

$$55. f(2) = \frac{2}{9} (8+1)^{3/2} = \frac{2}{9} (9)^{3/2} = \frac{2}{9} (27) = 6$$

$$f(0) = \frac{2}{9} (0+1)^{3/2} = \frac{2}{9} (1) = \frac{2}{9}$$

$$\frac{1}{2} \left(6 - \frac{2}{9} \right) = \frac{1}{2} \left(\frac{52}{9} \right) = \boxed{\frac{26}{9}}$$

$$56. 2 = 3 \ln e^1 + C$$

$$2 = 3(1) + C$$

$$\boxed{C = -1}$$

$$57. 6 = \frac{1}{2} \ln 1 - \frac{3}{4} (1) + C$$

$$6 + \frac{3}{4} = C$$

$$\boxed{C = \frac{27}{4}}$$

$$58. \left(\sec \left(\frac{2\pi}{6} \right) \right)^2 = \left(\sec \frac{\pi}{3} \right)^2 = 2^2 = \boxed{4}$$

$$59. f(4) = e^4 - 8$$

$$f(0) = e^0 - \frac{1}{2} = 1 - \frac{1}{2} = \frac{1}{2}$$

$$f(4) - f(0) = e^4 - 8 - \frac{1}{2} = \boxed{e^4 - \frac{17}{2}}$$

$$60. f(0) = \frac{3}{2} \sqrt{1 + \tan 0} \cdot (\sec 0)^2 = \frac{3}{2} \sqrt{1} \cdot 1^2 = \boxed{\frac{3}{2}}$$

$$61. f(4) = \frac{3}{5} (8)^{5/3} = \frac{3}{5} (\sqrt[3]{8})^5 = \boxed{\frac{96}{5}}$$

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62. $f(3) = -3 - \frac{9}{2} + \frac{27}{3}$

$$= \frac{-18 - 27 + 54}{6} = \frac{9}{6} = \boxed{\frac{3}{2}}$$

63. $f(4) = -2 - 16 + \frac{64}{3} = \frac{-6 - 48 + 64}{3} = \frac{10}{3}$

$$f(2) = -1 - 4 + \frac{8}{3} = \frac{-3 - 12 + 8}{3} = \frac{-7}{3}$$

$$f(4) - f(2) = \frac{10}{3} - \frac{-7}{3} = \boxed{\frac{17}{3}}$$

64. $f(-3) = 2(9) = 18$
 $f(1) = 3$

$$f(-3) + f(1) = \boxed{21}$$

65. $2^3 \cdot 2^m = \boxed{2^{m+3}}$

66. $(a^k + 3)(a^k - 2) = \boxed{a^{2k} + a^k - 6}$

67. $x^{8/8} - 10x^{16/8} = \boxed{x - 10x^2}$

68. $\boxed{-\frac{\sqrt{3}}{2}}$

69. $\boxed{\frac{\sqrt{2}}{2}}$

70. $\boxed{135^\circ, 315^\circ}$ or $\boxed{\frac{3\pi}{4}, \frac{7\pi}{4}}$

71. $\boxed{270^\circ}$ or $\boxed{\frac{3\pi}{2}}$

72. $\cos \frac{9\pi}{4} = \cos \frac{\pi}{4} = \boxed{\frac{\sqrt{2}}{2}}$

$$73. \boxed{60^\circ, 120^\circ \text{ or } \frac{\pi}{3}, \frac{2\pi}{3}}$$

$$74. \tan \frac{7\pi}{6} = \frac{1}{2} \cdot \frac{2}{\sqrt{3}} = \frac{1}{\sqrt{3}} = \boxed{\frac{\sqrt{3}}{3}}$$

$$75. \boxed{180^\circ \text{ or } \pi}$$

$$76. \frac{1}{\frac{\sqrt{3}}{2}} = \frac{2}{\sqrt{3}} = \boxed{\frac{2\sqrt{3}}{3}}$$

$$77. \begin{array}{r} x^3 + 1 \overline{) x^5 - x^4 + x^3 + 2x^2 - x + 4} \\ \underline{-(x^5 + x^2)} \\ -x^4 + x^3 + x^2 - x + 4 \\ \underline{-(-x^4 - x)} \\ x^3 + x^2 + 4 \\ \underline{-(x^3 + 1)} \\ x^2 + 3 \end{array}$$

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

$$78. \begin{array}{r} 2 \overline{) 12 - 23 - 3 2} \\ \underline{24 - 2} \\ 12 - 1 0 \end{array}$$

$$12x^2 + x - 1 = 0$$

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

$$\boxed{x = -\frac{1}{3}, \frac{1}{4}, 2}$$

$$79. 3x - 7 = y$$

$$x + 5(3x - 7) = -3$$

$$x + 15x - 35 = -3$$

$$16x = 32$$

$$\boxed{x = 2 \quad y = -1}$$

$$80. x = t + 1 \Rightarrow t = x - 1$$

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

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

$$\boxed{y = x^2 - x \text{ or } x^2 - x - y = 0}$$

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81. $x+1 = \sqrt[3]{t}$ $t = (x+1)^3$

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

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

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

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

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

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

$$x^2 + 2x + 1$$

$$x^3 + 3x^2 + 3x + 1$$

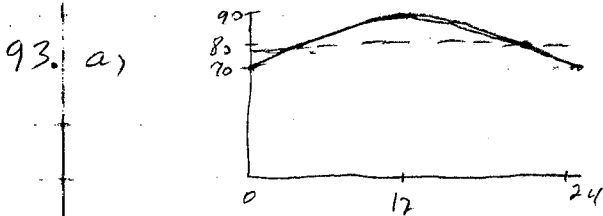
82. $\sin^{-1} x = t$ $y = \cos(\sin^{-1}(x))$

83-89. On Graph Paper (Last Page)

90. $x = -0.39$

91. 3

92. occurs at ≈ -0.5 with a value of -0.368



b) $[5.23, 18.77]$

94. 3

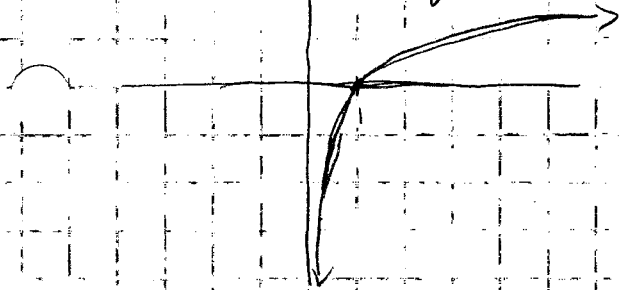
95. $x = 30.174$

96. $(-\infty, 1]$

97. $(-\infty, 1) \cup (1, \infty)$

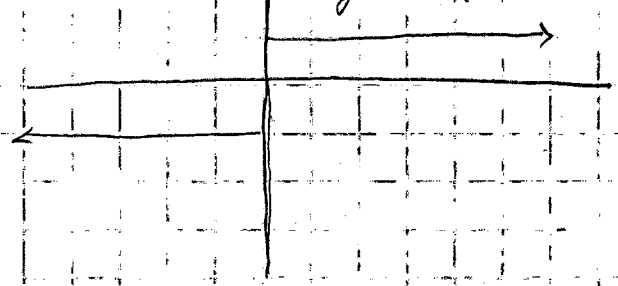
83.

$$y = \ln(x)$$



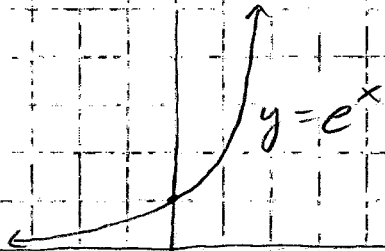
84.

$$y = \frac{|x|}{x}$$



85.

$$y = e^x$$



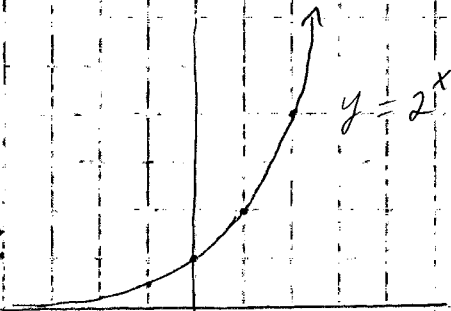
86.

$$y = e^{-x}$$



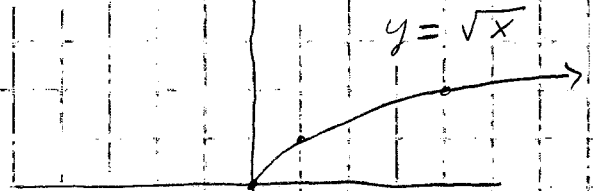
87.

$$y = 2^x$$



88.

$$y = \sqrt{x}$$



89.

