7.1 Pg 345

3. $9^{2x} = 9^8$

$2x = 8$

$x = 4$

5. $3^x = \left(\frac{1}{3}\right)^{x+1}$

$\left(\frac{1}{3}\right)^{-x} = \left(\frac{1}{3}\right)^{x+1}$

$-x = x + 1$

$-2x = 1$

$x = -1/2$

7. $4^{-x} = 2^{x+1}$

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

$2^{-2x} = 2^{x+1}$

$-2x = x + 1$

$-3x = 1$

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

9. $K^{3/2} = 27$

$\left[K^{3/2}\right]^{2/3} = 27^{2/3}$

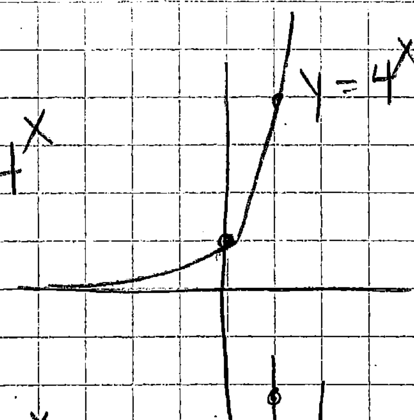
$K = \left(\sqrt[3]{27}\right)^2$

$K = 3^2$

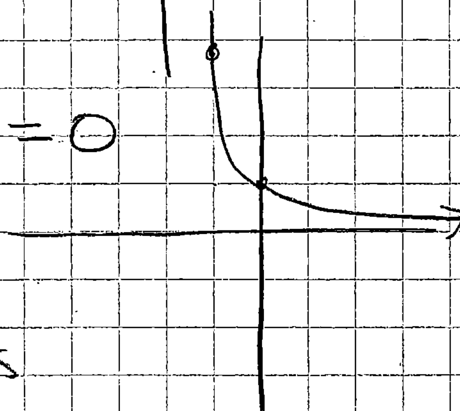
$K = 9$

11. $\lim_{x \to \infty} 4^x$

$= \infty$



12. $\lim_{x \to \infty} 4^{-x} = 0$



4^{-x} reflection over y-axis

13. $\lim_{x \to \infty} \left(\frac{1}{4}\right)^{-x}$

$\left(\frac{1}{4}\right)^{-x} = \left(4^{-1}\right)^{-x} = 4^x$

$\lim_{x \to \infty} \left(\frac{1}{4}\right)^{-x} = \lim_{x \to \infty} 4^x = \infty$

15. $y = 4e^x \quad x = 0$

$x = 0$
$y = 4e^0$
$y = 4$
$(0,4)$

$y' = 4e^x$

$x = 0$
$y' = 4$
$m = 4$

$y - 4 = 4(x - 0)$
$y = 4x + 4$

17. $y = e^{x+2} \quad x = -1$

$x = -1$
$y = e^{-1+2}$
$y = e$
$(-1, e)$

$y' = e^{x+2}(1)$

$x = -1$
$y' = e^{-1+2}(1)$
$y' = e$
$m = e$

$y - e = e(x - (-1))$
$y = ex + e + e$
$y = ex + 2e$
$y = e(x+2)$

19. $f(x) = 7e^{2x} + 3e^{4x}$

$f'(x) = 7e^{2x}(2) + 3e^{4x}(4)$
$= 14e^{2x} + 12e^{4x}$

21. $f(x) = e^{\pi x}$

$f'(x) = e^{\pi x}(\pi)$
$= \pi e^{\pi x}$

23. $f(x) = e^{-4x+9}$

$f'(x) = e^{-4x+9}(-4)$
$= -4e^{-4x+9}$

25. $f(x) = \dfrac{e^{x^2}}{x}$

Quotient Rule

$f'(x) = \dfrac{x \cdot e^{x^2}(2x) - e^{x^2}(1)}{x^2}$

$= \dfrac{e^{x^2}[2x^2 - 1]}{x^2}$

27. $f(x) = (1+e^x)^4$

Chain Rule

$$f'(x) = 4(1+e^x)^3(0+e^x)$$
$$= 4e^x(1+e^x)^3$$

29. $f(x) = e^{x^2+2x-3}$

$$f'(x) = e^{x^2+2x-3} \cdot (2x+2)$$
$$= (2x+2)e^{x^2+2x-3}$$

31. $f(x) = e^{\sin x}$

$$f'(x) = e^{\sin x} \cdot (\cos x)$$
$$= \cos x \, e^{\sin x}$$

33. $f(\theta) = \sin(e^\theta)$

$$f'(\theta) = \cos(e^\theta) \cdot e^\theta \cdot 1$$
$$= e^\theta \cos(e^\theta)$$

35. $f(t) = \dfrac{1}{1-e^{-3t}}$

Quotient

$$f'(t) = \frac{(1-e^{-3t})(0) - (1)(-e^{-3t} \cdot (-3))}{(1-e^{-3t})^2}$$

$$= \frac{-3e^{-3t}}{(1-e^{-3t})^2}$$

37. $f(x) = \dfrac{e^x}{3x+1}$ Quotient Rule

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

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

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

39. $f(x) = \dfrac{e^{x+1}+x}{2e^x-1}$

$$f'(x) = \frac{(2e^x-1)(e^{x+1}\cdot(1)+1) - (e^{x+1}+x)(2e^x)}{(2e^x-1)^2}$$

$$= \frac{2e^{2x+1} + 2e^x - e^{x+1} - 1 - 2e^{2x+1} - 2xe^x}{(2e^x-1)^2}$$

$$= \frac{2e^x - e^{x+1} - 1 - 2xe^x}{(2e^x-1)^2}$$

41. $f''(x)$ $f(x) = e^{4x-3}$

$$f'(x) = e^{4x-3}\cdot 4$$
$$= 4e^{4x-3}$$

$$f''(x) = 4e^{4x-3}\cdot 4$$
$$= 16e^{4x-3}$$

45. $\frac{d^2}{dt} e^{t-t^2}$

$y = e^{t-t^2}$

$\frac{dy}{dt} = e^{t-t^2} \cdot (1-2t)$

product

$\frac{d^2y}{dt^2} = e^{t-t^2} \cdot (-2) + e^{t-t^2} \cdot (1-2t)(1-2t)$

$\frac{d^2y}{dt^2} = e^{t-t^2} [-2 + (1-2t)^2]$

56. $y = e^{-x^2}$

$y' = e^{-x^2} \cdot (-2x)$

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

$y'' = -2e^{-x^2} + (-2x) e^{-x^2} \cdot (-2x)$

$= -2e^{-x^2} + 4x^2 e^{-x^2}$

$y'' = e^{-x^2} [-2 + 4x^2]$

$e^{-x^2} \neq 0 \quad -2 + 4x^2 = 0$

$4x^2 = 2$

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

$x = \pm \frac{1}{\sqrt{2}}$

$-2x e^{-x^2} = 0$

$x = 0$

$(-\infty, 0) \quad (0, \infty)$

$x = -1 \quad x = 1$

sign $f'(x)$ $+$ $-$

Max at $x = 0$

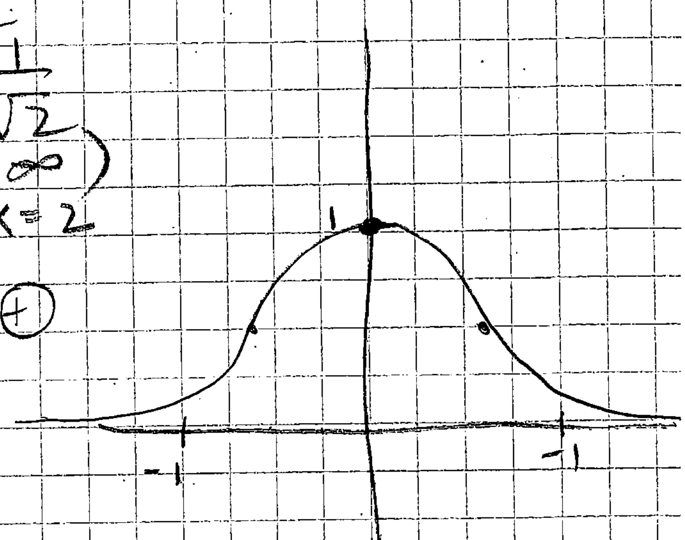
$f(0) = e^0 = 1$

$(0, 1)$

$(-\infty, -\frac{1}{\sqrt{2}}) \; (-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}) \; (\frac{1}{\sqrt{2}}, \infty)$

$x = -2 \quad x = 0 \quad x = 2$

sign $f''(x)$ $+$ $-$ $+$



Inflection points when

$x = \pm \frac{1}{\sqrt{2}}$

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

$\approx (\pm .7, .6)$

69. $\int (e^x + 2)\,dx$

$= e^x + 2x + C$

71. $\int_0^1 e^{-3x}\,dx = \int_0^{-3} e^u \cdot \frac{du}{-3}$

$u = -3x$ $\quad x = 0$

$\frac{du}{dx} = -3$ $\quad u = 0$ $\quad = -\frac{1}{3} e^u \Big]_0^{-3}$

$\frac{du}{-3} = dx$ $\quad x = 1$

$u = -3$ $\quad = -\frac{1}{3}\left[e^{-3} - e^0\right]$

$= -\frac{1}{3}\left[\frac{1}{e^3} - 1\right]$

73. $\int_0^3 e^{1-6t}\,dt = \int_1^{-17} e^u \frac{du}{-6}$

$u = 1 - 6t$ $\quad t = 0$

$\frac{du}{dt} = -6$ $\quad u = 1$ $\quad = -\frac{1}{6} e^u \Big]_1^{-17}$

$\frac{du}{-6} = dt$ $\quad t = 3$

$u = 1 - 6(3)$ $\quad = -\frac{1}{6}\left[e^{-17} - e^1\right]$

$u = -17$

75. $\int e^{4x} + 1\,dx = \int e^{4x}\,dx + \int 1\,dx$

$u = 4x$ $\quad = \int e^u \frac{du}{4} + x + C$

$\frac{du}{dx} = 4$

$\frac{du}{4} = dx$ $\quad = \frac{1}{4} e^{4x} + x + C$

77. $\int_0^1 x e^{-x^2/2}\,dx = \int_0^{-1/2} e^u \cdot \frac{du}{-1}$

$u = -\frac{x^2}{2}$ $\quad$ $x=0$, $u=0$ $\quad$ $= -e^u \Big]_0^{-\frac{1}{2}}$

$\frac{du}{dx} = -\frac{2x}{2}$ $\quad$ $x=1$, $u=-\frac{1}{2}$ $\quad$ $= -e^{-\frac{1}{2}} + e^0$

$\frac{du}{-1} = x\,dx$ $\quad$ $= 1 - e^{-1/2}$

79. $\int e^t \sqrt{e^t+1}\,dt = \int u^{1/2} \cdot du$

$u = e^t + 1$ $\quad$ $= \frac{2}{3} u^{3/2} + C$

$\frac{du}{dt} = e^t$

$du = e^t\,dt$ $\quad$ $= \frac{2}{3}\left(e^t+1\right)^{3/2} + C$

81. $\int \frac{e^{2x} - e^{4x}}{e^x}\,dx$

$= \int \frac{e^{2x}}{e^x} - \frac{e^{4x}}{e^x}\,dx$

$= \int e^x - e^{3x}\,dx$

$u = 3x$

$= \int e^x\,dx - \int e^{3x}\,dx$ $\quad$ $du = 3dx$

$\frac{du}{3} = dx$

$= e^x - \int e^u \cdot \frac{du}{3}$

$= e^x - \frac{1}{3} e^{3x} + C$

83. $\int \frac{e^x}{\sqrt{e^x+1}}\,dx = \int \frac{1}{u^{1/2}} \cdot du$

$u = e^x + 1$
$du = e^x\,dx$

$= \int u^{-1/2}\,du$

$= \frac{2}{1} u^{1/2} + C$

$= 2\sqrt{e^x+1} + C$

85. $\int \frac{e^{\sqrt{x}}\,dx}{\sqrt{x}} = \int e^u \cdot (2du)$

$= 2e^u + C$

$u = \sqrt{x}$

$\frac{du}{dx} = \frac{1}{2} e^{-\frac{1}{2}}$

$= 2e^{\sqrt{x}} + C$

$2du = \frac{1}{\sqrt{x}}\,dx$