## Section 2.2

**32.** $\lim\limits_{x\to 5^-} \dfrac{x+1}{x-5} = -\infty$, since the numerator is positive and the denominator approaches 0 through negative numbers so sign is negative.

## Section 2.3

**2.** (c) $\lim\limits_{x\to -1} [f(x)\,g(x)] = \lim\limits_{x\to -1} f(x) \cdot \lim\limits_{x\to -1} g(x) = 1\cdot(2) = 2,$

(d) $\lim\limits_{x\to 3} \dfrac{f(x)}{g(x)} = d.n.e.$ since $\lim\limits_{x\to 3^-} \dfrac{f(x)}{g(x)} = \infty \neq \lim\limits_{x\to 3^+} \dfrac{f(x)}{g(x)} = -\infty,$

(e) $\lim\limits_{x\to 2} [x^2\,f(x)] = \lim\limits_{x\to -1} x^2 \cdot \lim\limits_{x\to -1} f(x) = 4(-1) = -4,$

**22.** $\dfrac{2}{3}$ **24.** $-\dfrac{1}{9}$

## Chapter 2 Review:

**18.** Since $\lim\limits_{x\to\infty} (x-x^2) = \lim\limits_{x\to\infty} x(1-x) = \infty(-\infty) = -\infty$ so $\lim\limits_{x\to\infty} e^{x-x^2} = 0$

## Section 3.2

**12.** $f'(z) = 1 - ze^z - 2e^{2z}$ **14.** $y' = \dfrac{2-x}{2\sqrt{x}(2+x)^2}$

**32.** $y' = \dfrac{1-xe^x}{(1+e^x)^2}$ and the tangent line is $y = \dfrac{1}{4}x + \dfrac{1}{2}$

**34.** $y' = \dfrac{2-2x^2}{(x^2+1)^2}$ and the tangent line is $y = 1$

## Section 3.3

**22.** $y' = e^x(\cos x - \sin x)$ and the tangent line is $y = x+1$

**30.** $f'(t) = \sec t \tan t$, and $f''(t) = \sec t \tan^2 t + \sec^3 t = \sec t(\tan^2 t + \sec^2 t)$,
so $f''(\pi/4) = \sqrt{2}(1+2) = 3\sqrt{2}$.

## Section 3.5

**50.** $y' = \dfrac{2x}{1+x^4}$ **52.** $g'(x) = \dfrac{-1}{2\sqrt{x}\sqrt{1-x}}$ **56.** $R'(t) = -\dfrac{1}{\sqrt{t^2(t^2-1)}}$

## Section 3.6

**2.** $f'(x) = \ln x$ **34.** $y' = x + 2x\ln x$ and the tangent line is $y = x - 1$

## Chapter 3 Review

**12.** $y' = \dfrac{4\arcsin 2x}{\sqrt{1-4x^2}}$ **108.** $\lim\limits_{\theta\to\pi/3} \dfrac{\cos\theta - 0.5}{\theta - \pi/3} = \left[\dfrac{d}{d\theta}\cos\theta\right]_{\theta=\pi/s} = -\sin\dfrac{\pi}{3} = -\dfrac{\sqrt{3}}{2}$

## Section 4.3

**8.** (a) Increasing on $[0,\, 4) \cup (6,\, 8)$ as $f'(x) > 0$

(b) Local maximum at $x = 4$ and $x = 8$ as $f'$ changes its sign from positive to negative there and local minimum at $x = 6$ where $f'$ changes its sign from negative to positive.

(c) Concave up on $(0,\, 1) \cup (2,\, 3) \cup (5,\, 7)$ where $f'' > 0$ and concave down on $(1,\, 2) \cup (3,\, 5) \cup (7,\, \infty)$ where $f'' < 0$ .

(d) Points of inflections are at $x = 1,\, 2,\, 3,\, 5,\, 7$ where $f''$ changes its sign.

**52a.** Since $\lim\limits_{x\to\infty} \dfrac{e^x}{1-e^x} \overset{LH}{=} \lim\limits_{x\to\infty} \dfrac{e^x}{-e^x} = -1$ and $\lim\limits_{x\to-\infty} \dfrac{e^x}{1-e^x} = \dfrac{0}{1-0} = 0$

$y = -1$ and $y = 0$ are HA.

Since $\lim\limits_{x\to 0^+} f(x) = \dfrac{Positive}{Negative} = -\infty$, and $\lim\limits_{x\to 0^-} f(x) = \dfrac{Positive}{positive} = \infty$, so $x = 0$ is VA.

**56a.** Since $\lim\limits_{x\to\infty} e^{\arctan x} = e^{\pi/2}$ and $\lim\limits_{x\to-\infty} e^{\arctan x} = e^{-\pi/2}$,

So $y = e^{\pi/2}$ and $y = e^{-\pi/2}$ are HA.

There is no vertical asypmtote because $\arctan x$ is continuous for all $x$ and $e^t$ is continuous for all $t$.

## Section 4.4

**30.** $-\dfrac{1}{2}$

## Section 4.7

**14.** The dimension of the box with minimum amount of material used is $40\,cm \times 40\,cm \times 20\,cm$

**25.** When $r = 3$ , the dimensions of largest rectangle are $2x = 3\sqrt{2}$ and $2y = 3\sqrt{2}$ and when $r = 5$, the dimensions of largest rectangle are $2x = 5\sqrt{2}$ and $2y = 5\sqrt{2}$.

## Section 4.9

**6.** $F(x) = \dfrac{x^3}{3} - 5x^2 + 25x + C$

**16.** $R(\theta) = \sec\theta - 2e^\theta + C$,

**18.** $G(v) = 2\sin v - 3\arcsin v + C$

## Chapter 4 Review

**8.** $\dfrac{4}{3}$

**10.** $\infty$

**40b.** Remember that $\lim\limits_{x\to\infty} \dfrac{1}{x} = 0 = \lim\limits_{x\to-\infty} \dfrac{1}{x}$

so $\lim\limits_{x\to\infty} \dfrac{1}{1+e^{1/x}} = \dfrac{1}{1+1} = \dfrac{1}{2}$ , and $\lim\limits_{x\to-\infty} \dfrac{1}{1+e^{1/x}} = \dfrac{1}{1+1} = \dfrac{1}{2}$

Since $\lim\limits_{x\to 0^+} \dfrac{1}{x} = \infty$ so $\lim\limits_{x\to 0^+} e^{1/x} = \infty \Rightarrow \lim\limits_{x\to 0^+} f(x) = \dfrac{1}{\infty} = 0$

Since $\lim\limits_{x\to 0^-} \dfrac{1}{x} = -\infty$ so $\lim\limits_{x\to 0^+} e^{1/x} = 0 \Rightarrow \lim\limits_{x\to 0^+} f(x) = \dfrac{1}{1+0} = 1$

**70.** $f(u) = \frac{1}{2}u^2 + 2\sqrt{u} + \frac{1}{2}$

## Section 5.2

**34.** **(a)** $4$ **(b)** $-2\pi$ **(c)** $\frac{9}{2} - 2\pi$

## Section 5.3

**42.** $\frac{\pi}{3}$

## Section 5.4

**14.** $-\frac{1}{r} + 2\ln|r| + r + C$

**26.** $\left[\frac{1}{2}t^2 - \frac{2}{3}t^3 + \frac{1}{4}t^4\right]_{-1}^{1} = -\frac{4}{3}$

## Section 5.5

**32.** $\frac{1}{2}\ln(x^2+4) + C$

## Chapter 5 Review

**16.** $\frac{49}{15}$

**28.** $-\ln|1+\cot x| + C$

**38.** $\frac{15}{4}$