REVIEW ANSWERS

1.
   a. 6
   b. $\frac{5}{3}$
   c. $-\frac{1}{2}$
   d. DNE
   e. 0
   f. $\frac{\sqrt{3}}{2}$
   g. 6
   h. $\frac{1}{2\sqrt{a}}$

2. Only $h(x)$ is continuous at $x=1$

3.
   a. $\frac{1}{x}+\frac{9}{x^2}$
   b. $\frac{10}{(x+2)^2}$
   c. $6x\cos x-(3x^2+5)\sin x$
   d. $\frac{3x^2}{2\sqrt{x^3+7}}$
   e. $12\sin 6x\cos 6x+\frac{4}{3}x^{1/3}$
   f. $f'(g(x))g'(x)$
   g. $2x\sin x+x^2\cos x$
   h. $\frac{3}{\sqrt{1-9x^2}}+\sec^2 x+\frac{3}{x^4}$
   i. $30x^2+\frac{10}{4x^2+1}$

4.
   a. $f'(x^2+1)\cdot 2x$
   b. $4f'(5)$
   c. $2x^3f'(x^6+1)$
   d. $6x^5f'(x^6+1)$

5.
   a. $f(x)$ is continuous on $(-\infty,-1)$, $(-1,3)$, and $(3,\infty)$
   b. $f(x)$ is differentiable on $(-\infty,-1)$, $(-1,0)$, $(0,2)$, $(2,3)$, $(3,\infty)$

6.
   a. $f(x)$ is continuous at $x=2$ when $a=\frac{1}{2}$
   b. It is impossible for $f(x)$ to be differentiable at $x=2$ because the value $a=4$ that would be required causes $f(x)$ to stop being continuous at $x=2$ which is a necessary condition for a function to be differentiable.

7. Graph needed

8.
   a. Critical values are $x=1,2$
   b. Increasing on $(-\infty,1)$ and $(2,\infty)$
      Decreasing on $(1,2)$
   c. Relative maximum at $x=1$ which is the point $(1,5)$. Relative minimum at $x=2$ which is the point $(2,4)$
   d. Absolute maximum value is 9 which occurs when $x=3$
   e. Point of inflection is when $x=\frac{3}{2}$ which gives the point $\left(\frac{3}{2},\frac{9}{2}\right)$
   f. Concave up on $\left(\frac{3}{2},\infty\right)$ and concave down on $\left(-\infty,\frac{3}{2}\right)$

9. $.6<h'(x)<.8$

10.
   a. $y=\frac{3}{2}x+\left(\ln 4-\frac{3}{2}\right)$

b. $f(1.2) \approx .3 + \ln 4$
c. Probably this is a bit too big because the function is concave DOWN and thus the tangent line will lie above the graph of the function.

11.
a. $\frac{dy}{dx} = \frac{2x+y}{-x-2y}$
b. $(3,-6),(-3,6)$
c. $(6,-3),(-6,3)$

12.
a. 11
b. 10

13.
a. $y'' = 6x + 12\cos 2x - \frac{1}{x^2}$
b. $y'' = -\frac{4}{(4x-3)^{3/2}}$
c. $\frac{d^2y}{dx^2} = \frac{-x^2-y^2}{y^3} = -\frac{25}{y^3}$

14. 72π ft^3/min
15. A 6 by 6 foot square will maximize the area.
16.
a. Graph
b. Looks like at both 0 and 1
c. $\frac{5 \pm \sqrt{61}}{9} \approx \frac{13}{9}, -\frac{1}{3}$

17.
a. Increasing on $(-3,1),(3,4)$.
Decreasing on $(-4,-3),(1,3)$
b. Critical values are at $x = -3, 1, 3$
c. Relative maximum is at $x = 1$ because the function increases before arriving at 1 and then decreases after 1. Relative minima are at $x = -3$ and $x = 3$ because the function decreases before arriving at these values and increases after.
d. Inflection points are at $x = -1$ and $x = 2$ because the second derivative value is 0 at each and there is a change of concavity (indicated by sign changes in second derivative).
e. Concave up on $(-4,-1)$ and $(2,4)$. Concave down on $(-1,2)$

18.
a. He changes direction at $t = 7$ because there is a sign change in the velocity then.
b. His speed is greatest when $|v(t)|$ is the largest. This happens at $t = 10$.
c. $-\frac{3}{2}$ ft/sec^2

19.
20. $f(x) = b$, $f'(x) = a$, $f''(x) = c$
21. $y = 8x - 22$
22. $x = \pi$
23. $-\frac{9}{16}$
24.
a. Never
b. Sometimes
c. Question doesn't make sense because there are values that are NOT in the domain. Else it would be sometimes
d. Sometimes
e. Sometimes
f. Sometimes
g. Always
h. Always

25.
a. $v(t) = 3t^2 - 12t + 9$
b. At rest at $t = 1, 3$. Left on $(1,3)$.
Right on $(-\infty,1),(3,\infty)$
c. 3
d. $a(t) = 6t - 12$
e. -3