MATH 124B
Exam I - Version 1 - Hints and Answers
April 20, 2004

1. (a)
   i. 2
   ii. DNE
   iii. 1
   iv. 9
   v. 3
   (b)
   i. NO
   ii. YES
   iii. NO
2. (a) HINT: Multiply the expression in the limit by $\dfrac{\sqrt{x}+3}{\sqrt{x}+3}$.
   ANSWER: $\dfrac{1}{6}$
   (b) HINT: Multiply the expression in the limit by $\dfrac{\frac{1}{x^2}}{\frac{1}{x^2}}$.
   ANSWER: 0
   (c) HINT: As x approaches 2 from the left, $x+3$ approaches 5 and $2-x$ approaches 0. In particular, the numerator is positive and, since x is approaching 2 from the left, $2-x$ is also positive.
   ANSWER: $+\infty$
   (d) HINT: Since x is approaching 4 from the right, $4-x$ is negative. This means that $|4-x| = -(4-x) = x-4$. To receive full credit, you must demonstrate that you understand that this is true for any x larger than 4.
   ANSWER: 1
   (e) HINT: Factor and cancel.
   ANSWER: $-\frac{7}{3}$
3. HINT: Since $cx-3$ and $3-x+2x^2$ are polynomials, $f(x)$ is continuous at all values of x not equal to 2. If $f(x)$ is to be continuous at 2, we need $\lim\limits_{x\to 2^-} f(x)$ to be equal to $\lim\limits_{x\to 2^+} f(x)$. We have:

$$\lim_{x\to 2^-} f(x) = \lim_{x\to 2^-} cx-3 = 2c-3 \text{ and } \lim_{x\to 2^+} f(x) = \lim_{x\to 2^+} 3-x+2x^2 = 9.$$

   So, set $2c-3$ equal to 9 and solve for c.
   ANSWER: $c=6$
4. (a) HINT: $g'(a) = \lim\limits_{h\to 0} \dfrac{\frac{1}{a+h-4} - \frac{1}{a-4}}{h}$. Get a common denominator, combine fractions and cancel some h's.
   ANSWER: $g'(a) = \frac{-1}{(a-4)^2}$
   (b) HINT: The slope of the tangent line is $g'(0) = -\frac{1}{16}$. The y-intercept is $-\frac{1}{4}$.
   ANSWER: $y = -\frac{1}{16}x - \frac{1}{4}$
5. (a) ANSWER: $Q(0) = 1$ thousand people

(b) ANSWER: $Q(2) = 7.34$ thousand people

(c) ANSWER: $\lim_{x\to\infty} Q(t) = 20$. This means that, eventually, 20,000 people will catch the disease.

6. (a) HINT: Take $a = 120$ and $h = 30$.
   ANSWER: $v_{av} = 9.07$ feet per second

   (b) HINT: Take $h = 10$ and solve $v_{av} = 11.81$ for a.
   ANSWER: from $t = 1500$ to $t = 1510$

   (c) ANSWER: $v(a) = s'(a) = \lim_{h\to 0}(0.002a + 0.001h + 8.8) = 0.002a + 8.8$