MATH 120D - Autumn 2002
Exam 1, Version 1 - Hints and Answers

1. (a) HINT: The red bike's speed is **linear**. You know that $r(0) = 12$ and that $r(15) = b(15)$. You can easily find $b(15)$. You can use all this information to find that $r(t) = 1.0333t + 12$.
   ANSWER: $r(5) = 17.17$ feet per second
   (b) HINT: Let $d(t) = b(t) - r(t)$. This is a quadratic function. Use the vertex formula (or complete the square) to find where the vertex occurs.
   ANSWER: $t = 7.13$ seconds

2. (a) HINT: Use the fact that $3x + 2y = 10$ and $y = 11$ to find the x-coordinate of point B. Find the distance from A to B and use the ant's speed to find the time.
   ANSWER: 6.76 seconds
   (b) HINT: Find the equation of the circle and the x-coordinates of the points where the circle intersects the line $3x+2y = 10$. Of those two points, you are interested in the one close to point B.
   ANSWER: $x = -3.022$

3. (a) HINT: For $-4 \leq x \leq 0$, the function is a portion of the line through the points $(-4, -3)$ and $(0, 4)$. For $0 \leq x \leq 4$, the function is a portion of the circle centered at the origin with radius 4. For $4 \leq x \leq 6$, the function is a portion of the line through the points $(4, 0)$ and $(6, 2)$.
   ANSWER: $f(x) = \begin{cases} \frac{7}{4}x + 4 & \text{if } -4 \leq x \leq 0 \\ \sqrt{16 - x^2} & \text{if } 0 \leq x \leq 4 \\ x - 4 & \text{if } 4 \leq x \leq 6 \end{cases}$
   (b) HINT: The domain of $g(x)$ is the set of all x for which $f(x) \geq 0$.
   ANSWER: The domain of g is $\{x| -\frac{16}{7} \leq x \leq 6\}$.
   (c) ANSWER (in verbal form): Stretch the graph of f away from the x-axis by a factor of 2 and then shift the resulting graph up 3 units. Four points on the new graph are $(-8, 0)$, $(0, 7)$, $(8, 3)$, and $(12, 5)$.

4. (a) ANSWER: $6x + 3h - 5$
   (b) ANSWER: $9a - 5$

5. (a) ANSWERS: False, True
   (b) i. ANSWER: $f(g(x)) = |x| + 2 = \begin{cases} -x + 2 & \text{if } x < 0 \\ x + 2 & \text{if } x \geq 0 \end{cases}$
   ii. $g(f(x)) = |x + 2| \begin{cases} -(x + 2) & \text{if } x < -2 \\ x + 2 & \text{if } x \geq -2 \end{cases}$