1) | $t$ | $g(t)$ | $h(t)$ | $k(t)$ | $f(t)$ |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph</td>
<td>C</td>
<td>B</td>
<td>D</td>
<td>A</td>
</tr>
</tbody>
</table>

2) | $g(t)$ | $h(t)$ | $k(t)$ |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>$= -2t + 12$</td>
<td>$= 20(0.95)^t$</td>
</tr>
<tr>
<td>Estimate each at $t = 10$</td>
<td>-8</td>
<td>11.97</td>
</tr>
</tbody>
</table>

3) Given the following functions, find the graph that best represents each function:

<table>
<thead>
<tr>
<th>Function</th>
<th>$P = P_o (1.02)^t$</th>
<th>$P = P_o (0.97)^t$</th>
<th>$P = P_o + 20t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best represented by Graph</td>
<td>C</td>
<td>A</td>
<td>E</td>
</tr>
</tbody>
</table>

4)

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population grows at a rate of 500 per yr.</td>
<td>10,000</td>
<td>10,500</td>
<td>11,000</td>
<td>11,500</td>
</tr>
<tr>
<td>Population grows at a rate of 5% per yr.</td>
<td>10,000</td>
<td>10,500</td>
<td>11,025</td>
<td>11,576</td>
</tr>
</tbody>
</table>

5) a) $P = 150t + 6000$
   b) $P = 6000(1.02048)^t$
   c) $P = 50(0.887)^t$

6) $P = 50(0.887)^t$

7) a) $20$
   b) $C = 2.5q + 20$
   c) $C = 45$
   d) $q = 0.4C - 8$
   e) 8 units

8) a) $R = 90q$
   b) 2,000 units
   c) $C = 30q + 120,000$
   d) $P = 60q - 120,000$

9) $30.96$

10) a) $V = -2000t + 30000$
    b) $V = 0$ after 15 years
    c) $V = 0$

11) a) $p = 1, q = 3$ units
    b) $p = 1, q = 3$ units

12) a) $N = -30p + 1250$
    b) $N = 1100$
13) a) 32  b) 22  c) $D > S$ or shortage, the price should be pushed higher

14a) a) $t = -0.2027$  b) $t = 1.3219$  c) $t = 8.39$

d) $t = 0.4714$  e) $t = 0.47$  f) $t = 0.31396$

g) $t = 7.3891$  h) $t = 2$

14b) i) $P = 5000(1.0408)^t$  j) $P = 100e^{0.0296t}$

15) a) 4.081%  b) $11934.59$  c) 17.33 years

16) 20.11 years

17) a) $P = 16.37$  b) $t = 5.76$ years

18) $22,313.02$

19) $28,365.40$

20) $1250$

21) 13.86%

22) a) $t = 8.496$  b) $t = 8.154$

23) The half-life of a certain radioactive substance is 10 days. If there are 8 grams initially:

a) rate = 6.93%  b) $t = 20$ days

24) $t = 135.13$ hours

25) a) 2.23%  b) 31.06 years

26) a) the line segment corresponding to $f(b) - f(a)$; label that line segment as line A;

b) the line whose slope is given by $\frac{f(b) - f(a)}{b - a}$; label that line as line B;

c) the line whose slope is given by $f'(c)$; label that line as line C;

27) a) $P = 1.22412$ M  b) $Av = 12060$ / year  c) $f'(0) = 0.01194045$ M/year

28) a) $Av = 4.33$  b) $V = 6$
29) Draw a possible graph for the following functions (just show the shape of the graph):

   a) \( s(t) = mt - 4 \) where \( m > 0 \)  

   b) \( s(t) = mt + 4 \) where \( m < 0 \)

   c) \( s(t) = 5(a)^t \) where \( a > 1 \)  

   d) \( s(t) = 3(a)^t \) where \( a < 1 \)

30) If \( f(x) = x^2 - 2x \), find \( f'(2) \). (use only \( h = 0.001 \) and show all steps)

\[
\begin{align*}
\text{When } h &= 0.001, & f'(2) &= 2.001 \\
\text{When } h &= 1.999, & f'(2) &= 1.999 \\
\text{Then} & & f'(2) &= 2
\end{align*}
\]

31) Draw a possible graph of \( y = f(x) \) given the following information about its derivative:

   a) \( f'(x) < 0 \) for \( x < 1 \) and \( x > 3 \)  
      \( f'(x) > 0 \) for \( 1 < x < 3 \)  
      \( f'(x) = 0 \) at \( x = 1 \) and \( x = 3 \)

   b) \( f'(x) < 0 \) on \( x < 2 \) and \( 4 < x < 6 \)  
      \( f'(x) = 0 \) at \( x = 2 \) and \( x = 4 \) and \( x = 6 \)  
      \( f'(x) > 0 \) on \( 2 < x < 4 \) and \( x > 6 \)
32) a) Using the following graph, estimate the intervals or points where:

<table>
<thead>
<tr>
<th>$f'(x) &gt; 0$</th>
<th>$b &lt; x &lt; d$</th>
</tr>
</thead>
</table>
| $f'(x) < 0$ | $a < x < b$  
|             | $d < x < e$  |
| $f''(x) = 0$| $x = c$      |
| $f''(x) > 0$| $a < x < c$  |
| $f''(x) < 0$| $c < x < e$  |
| $f''(x) < 0$ and $f'(x) = 0$| $x = d$ |
| $f''(x) > 0$ and $f'(x) = 0$| $x = b$ |

b) Using the following graph, estimate the intervals or points where:

| $f'(x) > 0$ | $-2 < x < 0$  
<table>
<thead>
<tr>
<th></th>
<th>$x &gt; 3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f'(x) &lt; 0$</td>
<td>$0 &lt; x &lt; 3$</td>
</tr>
<tr>
<td>$f''(x) = 0$</td>
<td>$x = 1$</td>
</tr>
<tr>
<td>$f''(x) &gt; 0$</td>
<td>$1 &lt; x$</td>
</tr>
<tr>
<td>$f''(x) &lt; 0$</td>
<td>$x &lt; 1$</td>
</tr>
</tbody>
</table>

33) a) 3.8  
b) 3.4  

34) a) Every additional $1 in advertisement, there is $0.8 more in revenue.  
b) No because for every $1 spent, there $0.8 in revenue or -$0.2 in return  

Page 4
35) Draw a possible graph of a function whose:
   a) Second derivative is everywhere negative but first derivative is everywhere positive
   b) Second derivative is everywhere positive but first derivative is everywhere negative
   c) Second derivative is everywhere negative and first derivative is everywhere negative
   d) Second derivative is everywhere positive and first derivative is everywhere positive

36) a) Yes, MR>MC  
    b) No, MC>MR  
    c) 200 where MC = MR

37) | R > C | 20 < q < 70 | R' > C' | q < 50 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C &gt; R</td>
<td>q &lt; 20 ; q &gt; 70</td>
<td>C' &gt; R'</td>
<td>q &gt; 50</td>
</tr>
<tr>
<td>C = R</td>
<td>q = 20, q = 70</td>
<td>C' = R'</td>
<td>q = 50</td>
</tr>
</tbody>
</table>

What is the value of q that will maximize profit? q = 50
After producing 30 units, should the manufacturer produce more? Why? Yes, R' > C'
After producing 60 units, should the manufacturer produce more? Why? No, C' > R'

38) a) Av = 0.0152265  
    b) f'(4) = 0.0155323

39)
40) 

| The Original function is Increasing in: | \( a < x < b ; d < x < f \) |
| The Original function is Decreasing in: | \( b < x < d \) |
| The Original function has Inflection Points at: | \( x = c , x = e \) |
| The Original function has Horizontal Tangent line at: | \( x = b , x = d , x = f \) |

41) a) Left sum: 73.2 ; Right sum: 87.2 b) \( n = 5 \), \( \Delta t = 0.4 \)

42) a) The left hand sum = 7.7 b) The right hand sum = 5.7

43) a) The left hand sum = 14.6 b) The right hand sum = 11.4

44) 11.75
45) 34
46) 47.5
47) a) 100 b) 115