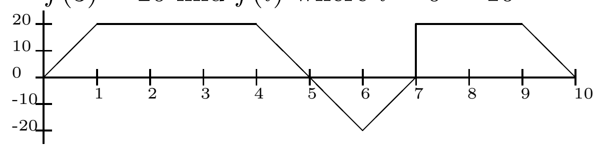
review #3

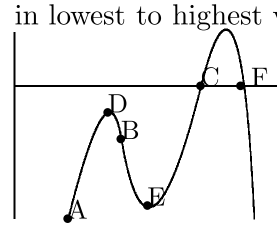
MATH 131

By: Greg Klein

1. First step do the problems on page 240.
2. Find the equation of the tangent line of $f(t) = 4t^3 + e^{3t}$ at $t = 1$
3. Find the 9th derivative of $g(t) = 2t^8 + e^{2t}$
4. The function $f(x) = -3x^3 - x^2 + x$ has slope of 0 at two places, find the coordinates of those points.
5. The function $g(x) = x^2$ has two tangents lines that go through the point (1,0), find the equation of the lines.
6. Let $f(x) = x^3 + 2x^2$
   (a) Use $f'(x)$ to determine where the function is increasing and decreasing.
   (b) Use $f''(x)$ to determine where the function is concave up and concave down.
7. Find the quadratic function $g(x) = ax^2 + bx + c$, which best fits the function $f(x) = 2x^2 + e^{2x}$, in that the functions, their first derivatives and second derivatives are all equal at $x = 0$.
8. The population of a herd of deer is modeled by $P(t) = 4000 + 400\sin(\frac{\pi t}{6}) + 180\sin(\frac{\pi t}{3})$, where t is measured in months from the first of April.
   (a) When is the herd largest?
   (b) When is the herd growing the fastest?
   (c) How fast is the herd growing on April 1st?
9. Suppose the depth of water in a bay is given by $d(t) = 10 + 7.5\cos(0.507t)$, with t being the number of hours after midnight.
   (a) What is the meaning of $d(2)$?
   (b) What is the meaning of $d'(2)$?
   (c) When is the tide changing fastest in the first twelve hours?
10. Given $p(x) = 3x^n - x^2$, find the intervals over which $p(x)$ is an increasing function when:
    (a) n=2
    (b) n=$\frac{1}{2}$
    (c) n=-1
11. This is a graph of the derivative of $f(x)$, if $f(3) = 20$ find $f(i)$ where $i = 0 \cdots 10$



12. Give all of the coordinates for the maxima and minima for the previous problem. Identify the global maximum and globabl minimum also.
13. Sketch the original function from the graph of the derivative. If possible put the points in lowest to highest value.



14. Find $F(2)$ if $F'(x) = 3 - x^4 + 4x$ and $F(1) = 3$
15. Sketch a graph of a function with only one local minima and two local maxima.
16. Find the values of a, b, c so that $g(x) = ax^3 + bx^2 + cx$ has critical points at 1 and -2, and passes through (1,1)
17. Find the maxima, minima and inflection points for $f(x) = (x^4 - x^2)e^{-x^2}$
18. Sketch a graph of a function with two critical points and only one inflection point.
19. Sketch a graph with one critical point and two inflection points.
20. For $f(x) = (x^4 - x^2)e^{-x^2}$ and $-1 \le x \le 2$ find the values for which the function has a global max and a global min.

21. A rumor spreads amoung 400 people by the following equation, $N(t) = \frac{400}{1+399e^{-0.4t}}$, with t being in hours.

   (a) Find N(0) and interpret it.
   (b) How many people will have heard the rumor after 2 hours? 10 hours?
   (c) Sketch a graph of the function.
   (d) How long will it take until half the people have heard the rumor? Almost all the people have heard the rumor?
   (e) When is the rumor spreading fastest?

Solutions.

1. See back of the book for the answers here.
2. $y-(4+e^3)=(12+3e^3)(x-1)$
3. 2^9e^{2t}
4. The coordinates are $(.2403, .1409)$ and $(-.4625, -.3796)$
5. $y-0=0(x-0)$ and $y-4=4(x-2)$
6. (a) increasing: x less than $\frac{-4}{3}$ and x greater than 0.
   decreasing: $\frac{-4}{3}<x<0$
   (b) concave down $x \leq \frac{-4}{6}$, concave up $x \geq \frac{-4}{6}$
7. $g(x)=4x^2+2x+1$
8. (a) June 1st
   (b) April 1st
   (c) 397.9 Deer/month
9. (a) depth of water at 2 am
   (b) the rate of change of the depth of water at 2 am
   (c) at 3.09 and 9.29 hours
10. (a) $x \geq 0$
   (b) $0 \leq x \leq .8254818122$
   (c) $x \leq -1.14$
11. $f(0)=-30, f(1)=-20, f(2)=0, f(3)=20, f(4)=40, f(5)=50, f(6)=40, f(7)=30, f(8)=50, f(9)=70, f(10)=80$
12. maximum at (5,50), minimum at (7,30), global max at 10, global min at 0
13. can't manage an acceptable graph. it decreases until C and then increases til F then decreases again.
14. Fundamental Theorem. $F(2)=5.8$
15. example is $-x^4+x^2$
16. $a=-.285, b=-.428, c=1.714$
17. critical values at 1.618,.618,0,-.618, -1.618 inflection values 2.055, 3.17,1.082,-1.082,-2.055,-3.17
18. see section 5.3
19. see section 5.3
20. Check the critical values from porblem 17 in the interval along with the endpoints.
21. (a) 1 person know the rumor
   (b) 2.218,48.14
   (c) looks like a normal logistic curve
   (d) 14.9 hours, 29.94 hours
   (e) 14.9 hours