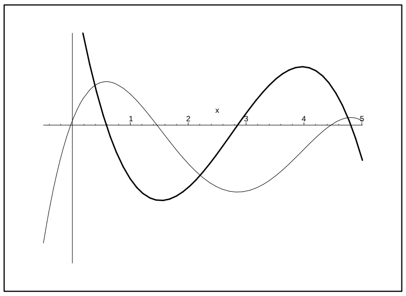
Review Problems for Test 2

Suggested Chapter 2 Review Problems: 3, 4, 5, 8, 11, 21, 24, 26, 28, 30, 31, 36, 38, 40. You might want to discuss the 'Check Your Understanding' questions (page 103) with a partner.
Suggested Chapter 3 Review Problems: 1, 5, 13, 31, 39, 51, 69, 70, 81

1. $f'(1) \approx 0.84$ can be found graphically or numerically

2. 

3. (a) dollars per percent
(b) $C'(r) > 0$ since $C(r)$ is an increasing function: the total cost of paying off a loan increases as the interest rate on the loan increases
(c) $C'(5)$ is the approximate additional total cost, in dollars, of paying off a loan if the interest rate on the loan is raised from 5% to 6%.

4. (a) $V(4) = 13.050$; When the car is 4 years old, it is worth approximately \$13,050.
(b) $V'(t) = 25(\ln .85)(.85)^t$ in thousands of dollars per year
(c) $V'(4) = -2.121$; When the car is 4 years old, its value is decreasing at a rate of \$2121 per year.

5. P is always positive, and is increasing and concave up until last year (population growing at an increasing rate), then increasing and concave down (population growing at a decreasing rate). P' is positive, increasing until last year, then decreasing (but still positive). P'' is positive and decreasing until last year, and now negative.

6. Values aren't marked on web graph. Mark as follows: x_1 is at the far left, x_2 is the first x-intercept, x_3 is at the local max, x_4 is the next x-intercept, x_5 is at the local min, and x_6 is at the last intercept.
(a) x_4, (b) x_1 (or possibly x_6), (c) x_1, (d) x_5, (e) x_6, (f) x_1

7. (a) Between $r = 0$ and $r = r_0$, graph is linear, through (0,0) and (r_0, kr_0). For $r > r_0$, the graph is decreasing and concave up, connected to the linear segment at (r_0, kr_0), and asymptotic to the horizontal axis for large values of r.
(b) E is continuous at r_0 because the two pieces of the function hook-up at (r_0, kr_0).
(c) E is not differentiable at r_0 because of the corner at (r_0, kr_0).

8. (a) $-17/25$, (b) $-1/4$, (c) 3

9. (a) -1, 5; (b) -1, 1, 3, 5, 6; (c) (i) 0; (ii) 0; (iii) -1; (iv) 1; (d) f is continuous at $x = 3$ since $\lim_{x\to 3} f(x) = f(3)$, but f is not differentiable at $x = 3$ since $\lim_{h\to 0} \frac{f(3+h)-f(3)}{h}$ does not exist.

10. (a) $f(t) = 8.9(0.99)^t$ gives millions of square kms of rainforest t years after 2000
(b) $f'(t) = 8.9 * (\ln 0.99) * (0.99)^t$,
(c) $f'(3) \approx -0.087$, which tells us that in 2003, rainforests are disappearing at a rate of approximately 87 thousand square km per year
(d) $f''(t) = 8.9 * (\ln 0.99)^2 * (0.99)^t$
(e) $f''(3) = 0.00087$, which tells us that the rate at which rainforests are disappearing is increasing at a rate of approximately 870 square km/yr per year

(f) $f^{-1}(8) = 10.61$, which means the area covered by rainforests will be 8 million square km sometime in 2011, roughly
(g) $\frac{dt}{dA}|_{A=8}$ tells us approximately how much time passed (it will be negative) when rainforests went from covering 9 million square km to 8 million square kms. The units are years per millions of square kms
(h) $\frac{dt}{dA}|_{A=8} \approx -12.44$, which says there were 9 million square kms of rainforest 12-13 years before 2000, or in 1987-1988, roughly

11. Yes. $f'(0) = \lim_{h\to 0} \dfrac{f(0+h) - f(0)}{h} = \lim_{h\to 0} \dfrac{h^2 \sin(1/h) - 0}{h} = \lim_{h\to 0} h \sin(1/h)$. Graphing $y = x\sin(1/x)$ (show your graph!!!), we see that $\lim_{h\to 0} h\sin(1/h) = 0$. Since the limit exists, f is differentiable at $x = 0$.

12. (a) $f(5) = 625$, which means that in 2000, the sand dune is 625 cm high.
(b) $f'(5) = -30$, which means that in 2000, the sand dune's height is decreasing at a rate of 30 cm per year.