Homework 19	Section 2.7	25, 29, 31, 34, 39, 41, 46

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

25) $f(x) = 3 - 2x + 4x^2$

$$f'(a) = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} = \lim_{h\to 0} \frac{[3 - 2(a+h) + 4(a+h)^2] - [3 - 2a + 4a^2]}{h}$$

$$= \lim_{h\to 0} \frac{3 - 2a - 2h + 4a^2 + 8ah + 4h^2 - 3 + 2a - 4a^2}{h}$$

$$= \lim_{h\to 0} \frac{-2h + 8ah + 4h^2}{h}$$

$$= \lim_{h\to 0} -2 + 8a + 4h$$

$$f'(a) = 8a - 2$$

29) $f(x) = 1/\sqrt{x+2}$

$$f'(a) = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} = \lim_{h\to 0} \frac{\frac{1}{\sqrt{(a+h)+2}} - \frac{1}{\sqrt{a+2}}}{h}$$

$$= \lim_{h\to 0} \frac{\frac{\sqrt{a+2} - \sqrt{a+h+2}}{\sqrt{a+h+2}\,\sqrt{a+2}}}{h}$$

$$= \lim_{h\to 0} \frac{\sqrt{a+2} - \sqrt{a+h+2}}{h(\sqrt{a+h+2}\,\sqrt{a+2})} \cdot \frac{\sqrt{a+2} + \sqrt{a+h+2}}{\sqrt{a+2} + \sqrt{a+h+2}}$$

$$= \lim_{h\to 0} \frac{a+2-a-h-2}{h(\sqrt{a+h+2}\,\sqrt{a+2})(\sqrt{a+2} + \sqrt{a+h+2})}$$

$$= \lim_{h\to 0} \frac{-1}{\sqrt{a+h+2}\,\sqrt{a+2}\,(\sqrt{a+2} + \sqrt{a+h+2}}$$

$$= \frac{-1}{\sqrt{a+2}\,\sqrt{a+2}\,(\sqrt{a+2} + \sqrt{a+2})} = \frac{-1}{(\sqrt{a+2})^2\,(2\sqrt{a+2}}$$

$$\boxed{f'(a) = -\frac{1}{2(a+2)^{3/2}}}$$

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

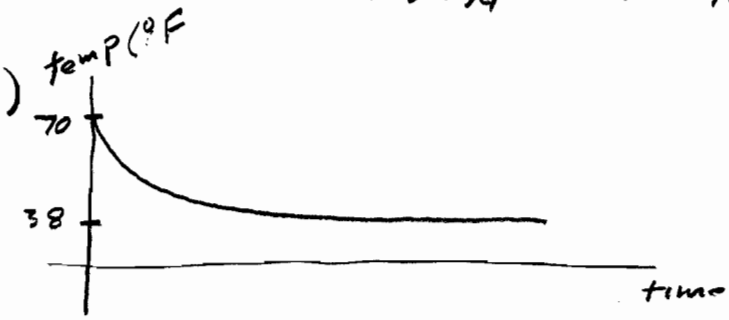
31) $f(x) = x^{10}$ $a = 1$

34) $f(x) = \tan x$, $a = \pi/4$

because $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$

$= \lim_{x \to \pi/4} \frac{\tan x - \tan(\pi/4)}{x - \pi/4}$ note: $\tan \pi/4 = 1$

39)



41) a i. $\frac{P(2002) - P(2000)}{2002 - 2000} = \frac{77 - 55}{2} = 11\%$ per year

ii. $P(2001) - P(2000) = \frac{68 - 55}{1} = 13\%$ per year

iii. $P(2000) - P(1999) = \frac{55 - 39}{1} = 16\%$ per year

b. $\frac{13 + 16}{2} = 14.5\%$ per year

c. <skip this part>

46) a. $f'(5)$ is rate of bacteria growth at time 5
Units are bacteria per hour

b. Unlimited space & food $f'(10) > f'(5)$
If space & food are limited, growth would likely slow over time and it is possible that $f'(10) < f'(5)$.