section 3.3

2) if function f is increasing on (a, b) and decreasing on (b, c), then the local extremum of f on (a, c) is a a local maximum and possible Absolute maximum

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4) both have same intervals of increasing $(0, \infty)$ and decreasing $(-\infty, 0)$.

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6) $g(x) = 2x^2 - 9$ on $[4, b]$

$g(4) = 2(4)^2 - 9 = 2(16) - 9 = 32 - 9 = 23$

$g(b) = 2(b)^2 - 9 = 2b^2 - 9$

$$\frac{g(b) - g(4)}{\boxed{b-4}} = \frac{(2b^2 - 9) - (23)}{\boxed{b-4}} = \frac{2b^2 - 32}{\boxed{b-4}} = \frac{2(b^2 - 16)}{\boxed{b-4}}$$

$$= \frac{2(b+4)(b-4)}{\boxed{b-4}} = \underline{\underline{2(b+4)}}$$

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8) $k(x) = 4x - 2$ on $[3, 3+h]$

$k(3) = 4(3) - 2 = 12 - 2 = 10$

$k(3+h) = 4(3+h) - 2 = 12 + 4h - 2 = 10 + 4h$

$$\frac{k(3+h) - k(3)}{\boxed{(3+h) - (3)}} = \frac{(10 + 4h) - (10)}{\boxed{h}} = \frac{4h}{\boxed{h}} = \underline{\underline{4}}$$

10) $g(x) = 3x^2 - 2$ on $[x, x+h]$

$$g(x+h) = 3(x+h)^2 - 2 = 3(x^2 + 2xh + h^2) - 2 = 3x^2 + 6xh + 3h^2 - 2$$

$$\frac{g(x+h) - g(x)}{\boxed{(x+h) - (x)}} = \frac{(3x^2 + 6xh + 3h^2 - 2) - (3x^2 - 2)}{\boxed{h}} = \frac{6xh + 3h^2}{\boxed{h}}$$

$$= \frac{h(6x + 3h)}{\boxed{h}} = \underline{\underline{6x + 3h}}$$

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12) $b(x) = \frac{1}{x+3}$ on $[1, 1+h]$ $\quad b(1) = \frac{1}{(1)+3} = \frac{1}{4}$

$$b(1+h) = \frac{1}{(1+h)+3} = \frac{1}{4+h}$$

GLCD $= (4)(4+h)$

$$\frac{b(1+h) - b(1)}{\boxed{(1+h) - (1)}} = \frac{\left(\frac{1}{4+h}\right) - \left(\frac{1}{4}\right)}{\boxed{h}} = \left(\frac{\frac{1}{4+h} - \frac{1}{4}}{\frac{\boxed{h}}{1}}\right)\left(\frac{\frac{(4)(4+h)}{1}}{\frac{(4)(4+h)}{1}}\right)$$

$$= \frac{1(4) - 1(4+h)}{\boxed{h}(4)(4+h)} = \frac{4 - 4 - h}{\boxed{h}(4)(4+h)} = \frac{-h}{\boxed{h}(4)(4+h)}$$

$$= \underline{\underline{\frac{-1}{4(4+h)}}}$$

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14) $r(t) = 4t^3$ on $[2, 2+h]$

$$r(2) = 4(2)^3 = 4(8) = 32$$

$$r(2+h) = 4(2+h)^3 = 4(2+h)(2+h)^2 = 4(2+h)(4 + 4h + h^2)$$

$$= 4(8 + 8h + 2h^2 + 4h + 4h^2 + h^3) = 4(8 + 12h + 6h^2 + h^3)$$

$$= 32 + 48h + 24h^2 + 4h^3$$

$$\frac{r(2+h) - r(2)}{\boxed{(2+h) - (2)}} = \frac{(32 + 48h + 24h^2 + 4h^3) - (32)}{\boxed{h}} = \frac{48h + 24h^2 + h^3}{\boxed{h}}$$

$$= \frac{h(48 + 24h + h^2)}{\boxed{h}} = \underline{\underline{48 + 24h + h^2}}$$

16) $f(1)=5$, $f(4)=4$

$$\frac{f(4)-f(1)}{(4)-(1)}=\frac{(4)-(5)}{4-1}=\frac{-1}{3}$$

18) Increasing: $(1,\infty)$ decreasing: $(-\infty,1)$

20) Increasing: $(-1.5,2)$ decreasing: $(-\infty,-1.5)\cup(2,\infty)$

22) Increasing: $(-\infty,-3)\cup(3,\infty)$ decreasing: $(-3,3)$

24) Increasing: $(-8,-3)\cup(3,7)$ decreasing: $(-3,3)$

26) a) between 2001, 243 sales ; 2002, 249 sales

$$\frac{(249)-(243)}{(2002)-(2001)}=\frac{6}{1}=6$$

b) between 2001, 243 sales ; 2004, 249 sales

$$\frac{(249)-(243)}{(2004)-(2001)}=\frac{6}{3}=2$$

28) $f(x)=x^2$ on $[1,5]$ $f(1)=(1)^2=1$ $f(5)=(5)^2=25$

$$\frac{f(5)-f(1)}{(5)-(1)}=\frac{(25)-(1)}{5-1}=\frac{24}{4}=6$$

30) $g(x) = x^3$ on $[-4, 2]$

$g(-4) = (-4)^3 = -64 \qquad g(2) = (2)^3 = 8$

$$\frac{g(2) - g(-4)}{(2) - (-4)} = \frac{(8) - (-64)}{2 + 4} = \frac{72}{6} = \underline{\underline{12}}$$

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32) $y = \frac{1}{x}$ on $[1, 3]$

$y\big|_{x=1} = \frac{1}{(1)} = 1 \qquad y\big|_{x=3} = \frac{1}{(3)} = \frac{1}{3}$

$$\frac{y\big|_{x=3} - y\big|_{x=1}}{(3) - (1)} = \frac{(\frac{1}{3}) - (1)}{3 - 1} = \frac{\frac{1}{3} - \frac{3}{3}}{2} = \frac{\frac{-2}{3}}{2} = \left(\frac{-2}{3}\right)\left(\frac{1}{2}\right) = \underline{\underline{\frac{-1}{3}}}$$

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34) $k(t) = 6t^2 + \frac{4}{t^3}$ on $[-1, 3]$

$k(-1) = 6(-1)^2 + \frac{4}{(-1)^3} = 6(1) + \frac{4}{(-1)} = 6 - 4 = 2$

$k(3) = 6(3)^2 + \frac{4}{(3)^3} = 6(9) + \frac{4}{27} = 54 + \frac{4}{27}$

$$\frac{k(3) - k(-1)}{(3) - (-1)} = \frac{(54 + \frac{4}{27}) - (2)}{3 + 1} = \frac{52 + \frac{4}{27}}{4} = \left(52 + \frac{4}{27}\right)\left(\frac{1}{4}\right)$$

$$= \left(\frac{52}{1}\right)\left(\frac{1}{4}\right) + \left(\frac{4}{27}\right)\left(\frac{1}{4}\right) = 13 + \frac{1}{27} = \left(\frac{13}{1}\right)\left(\frac{27}{27}\right) + \frac{1}{27}$$

$$= \frac{351}{27} + \frac{1}{27} = \underline{\underline{\frac{352}{27}}}$$