WARMUP

1) Calculate $f'(3)$ using definition of derivative if $f(x) = \frac{3}{2x}$

$$f'(3) = \lim_{h\to 0} \frac{f(3+h) - f(3)}{h} = \lim_{h\to 0} \frac{\frac{3}{2(3+h)} - \frac{3}{2\cdot 3}}{h} = \lim_{h\to 0} \frac{\frac{3}{2(3+h)} - \cancel{\frac{3}{6}}\frac{1}{2}}{h}$$

$$= \lim_{h\to 0} \frac{6 - 2(3+h)}{2(3+h)2h} = \lim_{h\to 0} \frac{\cancel{6} - \cancel{6} - 2h}{2(3+h)2h} = \lim_{h\to 0} \frac{\cancel{-2h}\,-1}{2(3+h)\cancel{2h}} = \frac{-1}{2(3+0)} = -\frac{1}{6}$$

2) Find the equation of the tangent line to the graph of $f(x) = \frac{3}{2x}$ when $x = 3$.

SLOPE:

$\to m = -\frac{1}{6}$

POINT:

$x = 3$

$f(3) = \frac{3}{2\cdot 3} = \frac{1}{2}$

$(3, \frac{1}{2})$

$$\frac{1}{2} = -\frac{1}{6}\cdot 3 + b$$

$$\frac{1}{2} = -\frac{1}{2} + b$$

$$+\frac{1}{2} \quad\quad +\frac{1}{2}$$

$$1 = b$$

$$y = -\frac{1}{6}x + 1$$

p76-77 7, 8, 9, 17, 19, 20, 21

17) $f(x) = x^3$

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

$$= \lim_{h\to 0} \frac{(-2+h)(-2+h)(-2+h) - (-8)}{h}$$

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

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

$$= \lim_{h \to 0} \frac{h^3 - 6h^2 + 12h}{h} = \lim_{h \to 0} \frac{\cancel{h}(h^2 - 6h + 12)}{\cancel{h}}$$

$$= \lim_{h \to 0} (h^2 - 6h + 12) = 12$$

Slope: $m = 12$

Point: $x = -2$, $f(-2) = -8$ $(-2, -8)$

$-8 = 12(-2) + b$

$-8 = -24 + b$

$16 = b$

$y = 12x + 16$

19) $f(x) = \frac{1}{x^2}$ at $(1,1)$

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

$$= \lim_{h \to 0} \frac{1 - (1+h)^2}{(1+h)^2 h}$$

$$= \lim_{h \to 0} \frac{1 - (1 + 2h + h^2)}{(1+h)^2 h}$$

$$= \lim_{h \to 0} \frac{\cancel{1} \cancel{-1} - 2h - h^2}{(1+h)^2 h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(-2-h)}{(1+h)^2 \cancel{h}} = \frac{-2-0}{(1+0)^2} = -2 = m$$

$m = -2$ point $= (1,1)$

$1 = -2 \cdot 1 + b$

$3 = b$

$y = -2x + 3$

20)