① b) $f(x) = 3x^5 - 6x^4 + 2$

$f'(x) = 15x^4 - 24x^3$

d) $g(x) = x^2 - \frac{2}{x^2} = x^2 - 2x^{-2}$

$g'(x) = 2x + 4x^{-3} = 2x + \frac{4}{x^3}$

j) $F(x) = \sqrt{x} + \sqrt[3]{x} + \sqrt[4]{x}$

$= x^{1/2} + x^{1/3} + x^{1/4}$

$F'(x) = \frac{1}{2}x^{-1/2} + \frac{1}{3}x^{-2/3} + \frac{1}{4}x^{-3/4}$

$= \frac{1}{2x^{1/2}} + \frac{1}{3x^{2/3}} + \frac{1}{4x^{3/4}}$

$= \frac{1}{2\sqrt{x}} + \frac{1}{3\sqrt[3]{x^2}} + \frac{1}{4\sqrt[4]{x^3}}$

k) $u(t) = a + \frac{b}{t} + \frac{c}{t^2} = a + bt^{-1} + ct^{-2}$

$u'(t) = -bt^{-2} - 2ct^{-3} = \frac{-b}{t^2} - \frac{2c}{t^3}$

l) $v(r) = \sqrt{r}(2+3r) = r^{1/2}(2+3r)$

$= 2r^{1/2} + 3r^{3/2}$

$v'(r) = r^{-1/2} + \frac{9}{2}r^{1/2} = \frac{1}{r^{1/2}} + \frac{9}{2}r^{1/2}$

$= \frac{1}{\sqrt{r}} + \frac{9\sqrt{r}}{2}$

4b) $f(x)=\boxed{\dfrac{2x-1}{4x}}$ $\quad f(x+h)=\dfrac{2(x+h)-1}{4(x+h)}$

$f(x+h)=\boxed{\dfrac{2x+2h-1}{4x+4h}}$

$$f'(x)=\lim_{h\to 0}\frac{\boxed{\dfrac{2x+2h-1}{4x+4h}}-\boxed{\dfrac{2x-1}{4x}}}{h}$$

$$=\lim_{h\to 0}\frac{4x(2x+2h-1)-(2x-1)(4x+4h)}{4xh(4x+4h)}$$

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

$$=\lim_{h\to 0}\frac{\cancel{4h}}{\cancel{4xh}(4x+4h)}=\boxed{\frac{1}{4x^2}}$$

6b) $y=2x^2-6\sqrt{x}$ at $(4,20)$

$y=2x^2-6x^{1/2}$

① $y'=4x-3x^{-1/2}$

$y'=4x-\dfrac{3}{\sqrt{x}}$

② $y'(4)=4(4)-\dfrac{3}{\sqrt{4}}$

$=16-\dfrac{3}{2}$

$=\dfrac{32}{2}-\dfrac{3}{2}$

$\boxed{=\dfrac{29}{2}} \leftarrow m$

③ $y-y_1=m(x-x_1)$

$y-20=\dfrac{29}{2}(x-4$

$y-20=\dfrac{29x}{2}-58$

$2y-40=29x-116$

$\boxed{0=29x-2y-76}$

8) Find the point on the curve $y=x\sqrt{x}$ where the tangent line is parallel to the line $6x-y=4$

① $y=x\sqrt{x}=x(x^{1/2})=x^{3/2}$

$y'=\dfrac{3x^{1/2}}{2}$

② $6x-y=4$

$6x-4=y$

$m=6$

③ $\dfrac{3\sqrt{x}}{2}=6$

$3\sqrt{x}=12$

$\sqrt{x}=4$

$\boxed{x=16}$

$y=x\sqrt{x}$

$y=(16)\sqrt{16}$

$\boxed{y=64}$

4 d) $y = \sqrt[3]{x}$, $(\underline{\underline{-8}}, -2)$

$x_1 \ , \ y_1$

1 Find Derivative

$y = x^{1/3}$

$y' = \frac{1}{3}x^{-2/3} = \frac{1}{3x^{2/3}}$

2 Fill in x value and solve for the slope. "m"

$y' = \frac{1}{3(-8)^{2/3}} = \frac{1}{3(4)} = \boxed{\frac{1}{12}}$

Slope of tangent

3 Use $y - y_1 = m(x - x_1)$

$y + 2 = \frac{1}{12}(x + 8)$

$12 \cdot \quad 12 \cdot y + 2 = \cancel{12} \cdot \frac{1x}{\cancel{12}} + \cancel{12} \cdot \frac{8}{\cancel{12}}$

$12y + 24 = x + 8$

$\boxed{0 = x - 12y - 16}$

③ c) $y = x + \frac{6}{x}$, $(\overset{x_1}{2}, \overset{y_1}{5})$ $m = \frac{-1}{2}$

① Find Derivative

$y = x + 6x^{-1}$

$y' = 1 - 6x^{-2}$

$y' = 1 - \frac{6}{x^2}$

② Sub in x-value $(x = 2)$

$y' = 1 - \frac{6}{(2)^2}$

$y' = \frac{4}{4} - \frac{6}{4}$

$y' = \frac{-2}{4} = \boxed{\frac{-1}{2}}$

Slope of the tangent "m"

③ Find the equation:

$y - y_1 = m(x - x_1)$

$2 \cdot y - 5 = \frac{-1}{2}(x - 2) \cdot 2$

$2y - 10 = -1(x - 2)$

$2y - 10 = -x + 2$

$\boxed{x + 2y - 12 = 0}$

4 a) $y=x^5$ $x=2$ Point $(2,32)$

$y=(2)^5$

$y=32$

$m=80$

1 Find Derivative

$y'=5x^4$

2 Sub in x-value $(x=2)$

$y'=5(2)^4$

$y'=5(16)$

$y'=\boxed{80}$

↑ Slope

3 Find the equation:

$y-y_1=m(x-x_1)$

$y-32=80(x-2)$

$y-32=80x-160$

$-80x+y+128=0$

$\boxed{80x-y-128=0}$

⑧ $y = x\sqrt{x}$

parallel to: $6x - y = 4$

$-y = -6x + 4$

$y = 6x - 4$

$m = 6$

$y = (x)(x^{1/2})$

$y = x^{3/2}$

$y' = \frac{3}{2}x^{1/2}$

$y' = \boxed{\frac{3\sqrt{x}}{2}}$

$6 = \frac{3\sqrt{x}}{2}$

$\frac{12}{3} = \frac{3\sqrt{x}}{3}$

$(4)^2 = (\sqrt{x})^2$

$\boxed{16 = x}$

∴ The point is (16, 64)

$y = x\sqrt{x}$

$y = (16)\sqrt{16}$

$y = 16(4)$

$\boxed{y = 64}$

① g)

$$y = \frac{x+1}{\sqrt{x}} = \frac{x+1}{x^{1/2}} = x^{-1/2}(x+1)$$

$$= x^{1/2} + x^{-1/2}$$

$$\boxed{y' = \frac{1}{2}x^{-1/2} - \frac{1}{2}x^{-3/2}}$$

$$y' = \frac{1}{2x^{1/2}} - \frac{1}{2x^{3/2}}$$

1 a) $f(x) = x^2 + 4x$

$f'(x) = 2x + 4$

d) $g(x) = x^2 - \frac{2}{x^2} = x^2 - 2x^{-2}$

$g'(x) = 2x + 4x^{-3}$

$g'(x) = 2x + \frac{4}{x^3}$

g) $y = \frac{x+1}{\sqrt{x}} = \frac{x+1}{x^{1/2}} = x^{-1/2}(x+1)$

$= x^{1/2} + x^{-1/2}$

$$\boxed{y' = \frac{1}{2}x^{-1/2} - \frac{1}{2}x^{-3/2}}$$

or $y' = \frac{1}{2x^{1/2}} - \frac{1}{2x^{3/2}}$

or $y' = \frac{1}{2\sqrt{x}} - \frac{1}{2\sqrt{x^3}}$

e) $h(x) = \sqrt{x} - 5x^4$

$= x^{1/2} - 5x^4$

$h'(x) = \frac{1}{2}x^{-1/2} - 20x^3$

$= \frac{1}{2x^{1/2}} - 20x^3$

(4) b) $y = 2\sqrt{x}$; $(\underset{x_1}{9}, \underset{y_1}{6})$; $m = \frac{1}{3}$

(1) Find Derivative

$$y = 2x^{1/2}$$

$$y' = 1x^{-1/2}$$

$$y' = \frac{1}{x^{1/2}} = \frac{1}{\sqrt{x}}$$

(2) Sub in x-value $(x=9)$

$$y' = \frac{1}{\sqrt{9}} = \boxed{\frac{1}{3}}$$

Slope of the tangent "m"

(3) Find the Equation

$$y - y_1 = m(x - x_1)$$

$$3 \cdot y - 3 \cdot 6 = 3 \cdot \frac{1}{3}(x - 9)$$

$$3y - 18 = 1(x - 9)$$

$$3y - 18 = x - 9$$

$$-x + 3y - 9 = 0$$

$$\boxed{x - 3y + 9 = 0}$$

7 $y = 3x^2$

$y' = 6x$

$24 = 6x$

$\boxed{4 = x}$

$y = 3(4)^2$

$y = 3(16)$

$\boxed{y = 48}$

$\therefore$ The point is $(4, 48)$

4

$$\boxed{f'(x) = \lim_{h \to 0} \frac{\boxed{f(x+h)} - \boxed{f(x)}}{h}}$$

b) $f(x) = \boxed{\frac{2x-1}{4x}}$

$f(x+h) = \frac{2(x+h)-1}{4(x+h)}$

$= \boxed{\frac{2x+2h-1}{4x+4h}}$

$$f'(x) = \lim_{h \to 0} \frac{\frac{2x+2h-1}{(4x+4h)} - \frac{(2x-1)}{(4x)}}{h}$$

$$= \lim_{h \to 0} \frac{4x(2x+2h-1) - (2x-1)(4x+4h)}{h(4x)(4x+4h)}$$

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

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

$$= \lim_{h \to 0} \frac{4\cancel{h}}{\cancel{h}(4x)(4x+4h)} = \frac{4}{(4x)^2} = \frac{4}{16x^2} = \boxed{\frac{1}{4x^2}}$$