1. a) $y = 4 - x^2$ $\quad x_0 = 1$ $\quad y_0 = 4 - 1^2 = 3$ $\quad P_0(1;3)$

$y' = -2x$ $\quad m = -2 \cdot 1 = -2$

$3 = -2 \cdot 1 + b$

$5 = b$

$\boxed{y = -2x + 5}$

1. b) $y = 2\sqrt{x}$ $\quad x_0 = 1$ $\quad y_0 = 2\sqrt{1} = 2$ $\quad P_0(1;2)$

$y' = 2 \cdot \frac{1}{2} x^{-\frac{1}{2}} = \frac{1}{\sqrt{x}}$ $\quad m = \frac{1}{\sqrt{1}} = 1$

$2 = 1 \cdot 1 + b \quad /-1$

$1 = b$

$\boxed{y = 1 \cdot x + 1}$

c) $y = x^3$ $\quad x_0 = -2$ $\quad y_0 = (-2)^3 = -8$ $\quad P_0(-2;-8)$

$y' = 3x^2$ $\quad m = 3 \cdot (-2)^2 = 12$

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

$-8 = -24 + b \quad /+24$

$16 = b$

$y = 12x + 16$

d) $y = \frac{x}{x-2}$ $\quad x_0 = 3$ $\quad y_0 = \frac{3}{3-2} = 3$ $\quad P_0(3;3)$

$y' = \frac{1 \cdot (x-2) - x \cdot 1}{(x-2)^2} = \frac{-2}{(x-2)^2}$ $\quad m = \frac{-2}{(3-2)^2} = -2$

$3 = -2 \cdot 3 + b \quad /+6$

$9 = b$

$\boxed{y = -2x + 9}$

(2) a) $\lim_{x\to 2} \frac{x^2-4}{x-2} = \lim_{x\to 2} \frac{(x-2)(x+2)}{x-2} = 2+2 = 4$

L'Hospital b) $\lim_{x\to 1} \frac{x^{10}-1}{x-1} = \lim_{x\to 1} \frac{10x^9}{1} = \frac{10\cdot 1^9}{1} = 10$

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

d) $\lim_{x\to 0} \frac{\sin 3x}{5x} = \lim_{x\to 0} \frac{\sin 3x}{3x}\cdot\frac{3}{5} = 1\cdot\frac{3}{5} = \frac{3}{5}$

e) $\lim_{x\to 0} \frac{\operatorname{tg} 2x}{7x} = \lim_{x\to 0} \frac{\sin 2x}{\cos 2x}\cdot\frac{1}{7x} = \lim_{x\to 0} \frac{\sin 2x}{7x}\cdot\frac{1}{\cos 2x} =$

$= \lim_{x\to 0} \frac{\sin 2x}{2x}\cdot\frac{2}{7}\cdot\underbrace{\frac{1}{\cos 2x}}_{\cos 0} = 1\cdot\frac{2}{7}\cdot\frac{1}{1} = \frac{2}{7}$

L'Hospital f) $\lim_{x\to\pi} \frac{\sin x}{x-\pi} = \lim_{x\to\pi} \frac{\cos x}{1} = \cos\pi = -1$

L'Hospital g) $\lim_{x\to 0} \frac{2^x-1}{x} = \lim_{x\to 0} \frac{2^x\cdot\ln 2}{1} = 2^0\cdot\ln 2 = 1\cdot\ln 2$

L'Hospital h) $\lim_{x\to 2} \frac{2^x-4}{x-2} = \lim_{x\to 2} \frac{2^x\cdot\ln 2}{1} = 2^2\cdot\ln 2 = 4\ln 2$

L'Hospital i) $\lim_{x\to 0} \frac{e^{2x}-1}{3x} = \lim_{x\to 0} \frac{e^{2x}\cdot 2}{3} = \frac{e^{2\cdot 0}\cdot 2}{3} = 1\cdot\frac{2}{3}$

L'Hospital j) $\lim_{x\to 0} \frac{e^x-1}{\sin 3x} = \lim_{x\to 0} \frac{e^x}{\cos 3x\cdot 3} = \frac{e^0}{3\cdot\cos 3\cdot 0} = \frac{1}{3\cdot 1} = \frac{1}{3}$