1E. Differentiation formulas, polynomials, products, quotients

1a)

$f(x) = x^{10} + 3x^5 + 2x^3 + 4$

$$\boxed{f'(x) = 10x^9 + 15x^4 + 6x^2}$$

1c)

$f(x) = \frac{x}{2} + \pi^3$

$$\boxed{f'(x) = \frac{1}{2}}$$

2b)

$f(x) = x^6 + 5x^5 + 4x^3$

$$\boxed{\int f(x) = \frac{x^7}{7} + \frac{5x^6}{6} + x^4 + C}$$

3)

$y' = 0$ at $x = 1, \frac{1}{3}$

4b)

$b = 59 - 2a$

5a)

$$\frac{d}{dx}\left(\frac{x}{1+x}\right) = \frac{1(1+x) - 1 \cdot x}{(x+1)^2} = \boxed{\frac{1}{(x+1)^2}}$$

5c)

$$\frac{d}{dx}\left(\frac{x+2}{x^2-1}\right) = \frac{1(x^2-1) - 2x(x+2)}{(x^2-1)^2} = \boxed{\frac{-x^2-4x-1}{(x-1)^2}}$$