Determine the derivative with respect to x for each of the following functions.

$y(x) = x^3 + 7x - 1$

$\frac{dy}{dx} = 3x^2 + 7$

$y(x) = 5x^3 + ax^{\frac{1}{2}} - x^{-1}$

$\frac{dy}{dx} = 15x^2 + \frac{a}{2}x^{-\frac{1}{2}} + x^{-2}$

$= 15x^2 + \frac{a}{2\sqrt{x}} + \frac{1}{x^2}$

$y(x) = 3ax^{3.2} + a^2x^{-\frac{1}{2}} - \frac{1}{x^2}$

$\frac{dy}{dx} = 9.6ax^{2.2} - \frac{a^2}{2}x^{-\frac{3}{2}} + 2x^{-3}$

$= 9.6ax^{2.2} - \frac{a^2}{2x^{1.5}} + \frac{2}{x^3}$

$y(x) = 4sin(x) - b^2cos(x)$

$\frac{dy}{dx} = 4\cos(x) + b^2\sin(x)$

$y(x) = asin(x) - 4cos(\pi)$

$\frac{dy}{dx} = a\cos(x)$

$y(x) = e^x + 10^x + ax^2 + \sqrt{x}$

$\frac{dy}{dx} = e^x + 10^x \ln(10) + 2ax + \frac{1}{2}x^{-\frac{1}{2}}$

$y(x) = (ax^2 + bx + c)(ax + b)$

$$\frac{dy}{dx} = (2ax + b)(ax+b) + (ax^2+bx+c)(a)$$
$$= 2a^2x^2 + 2abx + abx + b^2 + a^2x^2 + abx + ac$$
$$= 3a^2x^2 + 4abx + b^2 + ac$$

$y(x) = ax^{-\frac{3}{2}} sin(x)$

$$\frac{dy}{dx} = \left(-\frac{3a}{2}x^{-\frac{5}{2}}\right)(\sin(x)) + (ax^{-\frac{3}{2}})(\cos(x))$$

$y(x) = x^2 ln(x)$

$$\frac{dy}{dx} = (2x)(\ln(x)) + (x^2)\left(\frac{1}{x}\right)$$
$$= 2x\ln(x) + x$$

$y(x) = x^{-2} sin(x)$

$$\frac{dy}{dx} = (-2x^{-3})(\sin(x)) + (x^{-2})(\cos(x))$$

$y(x) = \dfrac{sin(x)}{x^2}$

$= (x^{-2})(\sin(x))$

$$\frac{dy}{dx} = (-2x^{-3})(\sin(x)) + (x^{-2})(\cos(x))$$

$y(x) = e^x(7 - \sqrt{x})$

$$\frac{dy}{dx} = (e^x)(7-\sqrt{x}) + (e^x)\left(-\frac{1}{2}x^{-\frac{1}{2}}\right)$$

$y(x) = Asin(fx + \phi) + B$

$$\frac{dy}{dx} = \left(A\cos(Fx + \phi)\right)(F)$$
$$= AF\cos(Fx + \phi)$$

$y(x) = (ax^2 + c)^4 + asin(x^2)$

$$\frac{dy}{dx} = 4(ax^2 + c)^3(2ax) + a\cos(x^2)(2x)$$
$$= 8ax(ax^2 + c)^3 + 2ax\cos(x^2)$$

$y(x) = (xsin(5x))^2$

$$\frac{dy}{dx} = 2(x\sin(5x))\left[(1)(\sin(5x)) + (x)[\cos(5x)(5)]\right]$$
$$= 2x\sin(5x)\left[\sin(5x) + 5x\cos(5x)\right]$$
$$= 2x\sin^2(5x) + 10x^2\sin(5x)\cos(5x)$$

$y(x) = a(x-1)^2 + sin(e^{3x}) + 4x$

$$\frac{dy}{dx} = 2a(x-1)(1) + \cos(e^{3x})(e^{3x})(3) + 4$$
$$= 2a(x-1) + 3e^{3x}\cos(e^{3x}) + 4$$

$y(x) = (x^3 + 2ax)sin(4fx + 2)$

$$\frac{dy}{dx} = (3x + 2a)(\sin(4Fx+2)) + (x^3+2ax)\cos(4Fx+2)(4F)$$
$$= (3x+2a)\sin(4Fx+2) + 4F(x^3+2ax)\cos(4Fx+2)$$