(Exercise # 3.3) (Q # 1-40)

Date ....

Ex # 1-12, find the first & Second Derivative.

① $y = -x^2+3$

Sol,

$y = -x^2+3$

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

$\frac{dy}{dx} = -2x+0$

$\boxed{\frac{dy}{dx} = -2x}$

Second Derivative :

$\boxed{\frac{d^2y}{dy^2} = -2}$

② $y = x^2+x+8$

Sol,

$y = x^2+x+8$

$\frac{dy}{dx} = \frac{d}{dx}(x^2) + \frac{d}{dx}(x) + \frac{d}{dx}(8)$

$\frac{dy}{dx} = 2x+1+0$

$\boxed{\frac{dy}{dx} = 2x+1}$

Second derivative :

$\boxed{\frac{d^2y}{dy^2} = 2}$

③ $S = 5t^3 - 3t^5$

Sol,

$S = 5t^3 - 3t^5$

$\frac{dy^s}{dt} = \frac{d}{dt}(5t^3) - \frac{d}{dt}(3t^5)$

$\frac{ds}{dt} = 5(3)t^2 - 3(5)t^4$

$\boxed{\frac{ds}{dt} = 15t^2 - 15t^4}$

Second derivative ,

$\boxed{\frac{d^2s}{dt^2} = 30t - 60t^3}$

④ $W = 3z^7 - 7z^3 + 21z^2$

Sol,

$W = 3z^7 - 7z^3 + 21z^2$

$\frac{dw}{dz} = \frac{d}{dz}(3z^7) - \frac{d}{dz}(7z^3) + \frac{d}{dz}(21z^2)$

$\frac{dw}{dz} = 3(7)z^6 - 7(3)z^2 + 21(2)z$

$\boxed{\frac{dw}{dz} = 21z^6 - 21z^2 + 42z}$

Second derivative;

$\frac{d^2w}{dz^2} = 21(6)z^5 - 21(2)z + 42$

$\boxed{\frac{d^2w}{dz^2} = 126z^5 - 42z + 42}$

⑤ $y = \frac{4x^3}{3} - x + 2e^x$

Sol,

$y = \frac{4x^3}{3} - x + 2e^x$

$\frac{dy}{dx} = y'(x) = \frac{d}{dx}\left(\frac{4x^3}{3}\right) - \frac{d}{dx}(x) + \frac{d}{dx}(2e^x)$

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

$\boxed{y'(x) = 4x^2 + 2e^x - 1}$

Second derivative,

$\frac{d^2y}{dx^2} = 4(2)x + 2e^x$

$\boxed{\frac{d^2y}{dx^2} = 8x}$.

Date ....

⑥ $y = \frac{x^3}{3} + \frac{x^2}{2} + \frac{x}{4}$

Sol,

$\frac{dy}{dx} = y'(x) = \frac{d}{dx}\left(\frac{x^3}{3} + \frac{x^2}{2} + \frac{x}{4}\right)$

$y'(x) = \frac{1}{3}\frac{d}{dx}(x^3) + \frac{1}{2}\frac{d}{dx}(x^2) + \frac{1}{4}\frac{d}{dx}(x)$

$y'(x) = \frac{1}{\cancel{3}}(\cancel{3})x^2 + \frac{1}{\cancel{2}}(\cancel{2})x + \frac{1}{4}(1)$

$\boxed{y'(x) = x^2 + x + 1}$

Second Derivative

$\boxed{y''(x) = 2x + 1}$

⑦ $w = 3z^{-2} - \frac{1}{z}$

Sol,

$\frac{dw}{dz} = w'(z) = \frac{d}{dz}\left(3z^{-2} - \frac{1}{z}\right)$

$\frac{dw}{dz} = 3\frac{d}{dz}(z^{-2}) - \frac{d}{dz}(z)^{-1}$

$\frac{dw}{dz} = 3(-2)z^{-3} - (-1)z^{-2}$

$\boxed{\frac{dw}{dz} = \frac{-6}{z^3} + \frac{1}{z^2}}$

Second Derivative:

$\frac{d^2w}{dz^2} = -6(-3)z^{-4} + (-2)z^{-3}$

$\boxed{\frac{d^2w}{dz^2} = \frac{18}{z^4} - 2z^{-3}} \Rightarrow \boxed{w''(z) = \frac{18}{z^4} - \frac{2}{z^3}}$

⑧ $s = -2t^{-1} + \frac{4}{t^2}$

Sol,

$\frac{ds}{dt} = s'(t) = 2\frac{d}{dt}(t)^{-1} + 4\frac{d}{dt}\left(\frac{1}{t^2}\right)$

$s'(t) = -2(-1)t^{-2} + 4(-2)t^{-3}$

$\boxed{s'(t) = +2/t^2 - \frac{8}{t^3}}$

Second Derivatives.

$s''(t) = +2(-2)t^{-3} - 8(-3)t^{-4}$

$\boxed{s''(t) = -\frac{4}{t^3} + \frac{24}{t^4}}$

⑨ $y = 6x^2 - 10x - 5x^{-2}$

Sol,

$\frac{dy}{dx} = y'(x) = 6\frac{d}{dx}(x^2) - 10\frac{d}{dx}(x) - 5\frac{d}{dx}(x^{-2})$

$y'(x) = 6(2)x - 10(1) - 5(-2)x^{-3}$

$\boxed{y'(x) = 12x + 10x^{-3} - 10}$

Second Derivative:

$y''(x) = 12(1) + 10(-3)x^{-4}$

$\boxed{y''(x) = 12 - 30/x^4}$

Date ....

(10) $y = 4 - 2x - x^{-3}$

Sol,

$\frac{dy}{dx} = y'(x) = \frac{d}{dx}(4) - 2\frac{d}{dx}(x) - \frac{d}{dx}(x^{-3})$

$y'(x) = 0 - 2(1) - (-3)x^{-4}$

$\boxed{y'(x) = 3x^{-4} - 2}$

Second Derivatives,

$y''(x) = 3(-4)x^{-5}$

$\boxed{y''(x) = -12/x^5}$

(11) $r = \frac{1}{3s^2} - \frac{5}{2s}$

Sol,

$\frac{dr}{ds} = r'(s) = \frac{1}{3}\frac{d}{ds} s^{-2} - \frac{5}{2}\frac{d}{ds}(s^{-1})$

$r'(s) = \frac{1}{3}(-2)s^{-3} - \frac{5}{2}(-1)s^{-2}$

$\boxed{r'(s) = -\frac{2}{3s^3} + \frac{5}{2s^2}}$

Second Derivatives,

$r''(s) = -\frac{2}{\cancel{3}}(-\cancel{3})s^{-4} + \frac{5}{\cancel{2}}(-\cancel{2})s^{-3}$

$\boxed{r''(s) = 2/s^4 + 5/s^3}$

(12) $r = \frac{12}{\theta} - \frac{4}{\theta^3} + \frac{1}{\theta^4}$

Sol,

$\frac{dr}{d\theta} = r'(\theta) = 12\frac{d}{d\theta}\theta^{-1} - 4\frac{d}{d\theta}\theta^{-3} + \frac{d}{d\theta}\theta^{-4}$

$r'(\theta) = 12(-1)\theta^{-2} - 4(-3)\theta^{-4} - 4\theta^{-5}$

$r'(\theta) = -12\theta^{-2} + 12\theta^{-4} - 4\theta^{-5}$

$\boxed{\frac{dr}{d\theta} = \frac{-12}{\theta^2} + \frac{12}{\theta^4} - \frac{4}{\theta^5}}$

Second Derivative

$\frac{d^2r}{d\theta^2} = -12(-2)\theta^{-3} + 12(-4)\theta^{-5} - 4(-5)\theta^{-6}$

$\boxed{\frac{d^2r}{d\theta^2} = \frac{24}{\theta^3} - \frac{48}{\theta^5} + \frac{20}{\theta^6}}$

(13) $y = (3 - x^2)(x^3 - x + 1)$

a) By applying Product rule.

b) By multiplying Factors

a) $y = (3 - x^2)(x^3 - x + 1)$

$y' = (3 - x^2)\frac{d}{dx}(x^3 - x + 1) + (x^3 - x + 1)\frac{d}{dx}(3 - x^2)$

$y' = (3 - x^2)(3x^2 - 1) + (x^3 - x + 1)(-2x)$

$y' = 9x^2 - 3 - 3x^4 + x + (-2x^4 + 2x^2 - 2x)$

$y' = 9x^2 - 3 - 3x^4 + x - 2x^4 + 2x^2 - 2x$

$\boxed{y' = -5x^4 + 12x^2 - 2x - 3}$

b) $y = (3 - x^2)(x^3 - x + 1)$

$y' = 3x^3 - 3x + 3 - x^5 + x^3 - x$

~~y' = taking derivative~~

Date ....

$$y' = 3\frac{d}{dx}(x^3) - 3\left(\frac{d}{dx}(x)\right) + \frac{d}{dx}(3) - \frac{d}{dx}x^5 + \frac{d}{dx}x^3 - \frac{d}{dx}x$$

$$y' = \cancel{x}\ 9x^2 - 3 + 0 - 5x^4 + 3x^2 - 1$$

$$\boxed{y' = 12x^2 - 5x^4 - 2x - 3}$$

(14) $y = (2x+3)(5x^2-4x)$.

a) Find by Product Rule:

$$\frac{dy}{dx} = (2x+3)\frac{d}{dx}(5x^2-4x) + (5x^2-4x)\frac{d}{dx}(2x+3) \Rightarrow (2x+3)(10x-4) + (5x^2-4x)(2)$$

$$\frac{dy}{dx} = 20x^2 - 8x + 30x - 12 + 10x^2 - 8x \Rightarrow \boxed{30x^2 + 14x - 12}$$

b) By Multiplying.

$y = (2x+3)(5x^2-4x) \Rightarrow 10x^3 - 8x^2 + 15x^2 - 12x$ taking derivati

$$y' = 10\frac{d}{dx}(x^3) - 8\frac{d}{dx}(x^2) + 15\frac{d}{dx}(x^2) - 12\frac{d}{dx}(x)$$

$$y' = 10(3)x^2 - 8(2)x + 15(2)x - 12$$

$$y' = 30x^2 - 16x + 30x - 12.$$

$$\boxed{y' = 30x^2 + 14x - 12}$$

(15) $y = (x^2+1)\left(x+5+\frac{1}{x}\right)$.

a) Finding by product Rule.

$$\frac{dy}{dx} = (x^2+1)\frac{d}{dx}\left(x+5+\frac{1}{x}\right) + \left(x+5+\frac{1}{x}\right)\frac{d}{dx}(x^2+1)$$

Date ....

$$\frac{dy}{dx} = (x^2+1)\left(\frac{d}{dx}(x) + \frac{d}{dx}(5) + \frac{d}{dx}(x^{-1})\right) + \left(x+5+\frac{1}{x}\right)\left(\frac{d}{dx}(x^2) + \frac{d}{dx}(1)\right)$$

$$\frac{dy}{dx} = (x^2+1)(1+0-x^{-2}) + \left(x+5+\frac{1}{x}\right)(2x+0)$$

$$\frac{dy}{dx} = (x^2+1)\left(1-\frac{1}{x^2}\right) + \left(x+5+\frac{1}{x}\right)(2x)$$

$$\frac{dy}{dx} = x^2 - \frac{\cancel{x^2}}{\cancel{x^2}} + 1 - \frac{1}{x^2} + 2x^2 + 10x + \frac{2\cancel{x}}{\cancel{x}}$$

$$\frac{dy}{dx} = x^2 \cancel{-1} \cancel{+1} - \frac{1}{x^2} + 2x^2 + 10x + 2 \Rightarrow \boxed{3x^2 + 10x + 2 - \frac{1}{x^2}}$$

b) By multiplying,

$$y = (x^2+1)\left(x+5+\frac{1}{x}\right)$$

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

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

$$y' = 3x^2 + 10x + 2 + 0 - x^{-2}$$

$$\boxed{y' = 3x^2 + 10x + 2 - \frac{1}{x^2}}$$

16 $y = (1+x^2)(x^{3/4} - x^{-3})$

a)

$$\frac{dy}{dx} = (1+x^2)\frac{d}{dx}(x^{3/4} - x^{-3}) + (x^{3/4} - x^{-3})\frac{d}{dx}(1+x^2)$$

$$\frac{dy}{dx} = (1+x^2)\left(\frac{3}{4}x^{-1/4} + 3x^{-4}\right) + (x^{3/4} - x^{-3})(2x)$$

$$\frac{dy}{dx} = \frac{3}{4}x^{-1/4} + 3x^{-4} + \frac{3}{4}x^{7/4} + 3x^{-2} + 2x^{7/4} - 2x^{-2}$$

Date ....

$$\boxed{\frac{dy}{dx} = \frac{3}{4}x^{-1/4} + \frac{3}{x^4} + \frac{11}{4}x^{7/4} + \frac{1}{x^2}}$$

b) Multiplying By:

$$y = (1+x^2)(x^{3/4} - x^{-3}) \Rightarrow x^{3/4} - x^{-3} + x^{11/4} - x^{-1}$$

$$\boxed{y' = \frac{3}{4x^{1/4}} + \frac{3}{x^4} + \frac{11}{4}x^{7/4} + \frac{1}{x^2}}$$

(17) Find The Derivatives of the Function:

(17) $y = \frac{2x+5}{3x-2}$

Using Formula:

$$\frac{u}{v} = \frac{vu' - uv'}{(v)^2}$$

$$\frac{dy}{dx} = \frac{(3x-2)\frac{d}{dx}(2x+5) - (2x+5)\frac{d}{dx}(3x-2)}{(3x-2)^2} \Rightarrow \frac{(3x-2)(2) - (2x+5)(3)}{(3x-2)^2}$$

$$\frac{dy}{dx} = \frac{\cancel{6x} - 4 - \cancel{6x} - 15}{(3x-2)^2} \Rightarrow \boxed{\frac{-19}{(3x-2)^2}}$$

(18) $z = \frac{4-3x}{3x^2+x}$

$$\frac{dy}{dx} = \frac{(3x^2+x)\frac{d}{dx}(4-3x) - (4-3x)\frac{d}{dx}(3x^2+x)}{(3x^2+x)^2}$$

$$\frac{dy}{dx} = \frac{(3x^2+x)(-3) - (4-3x)(6x+1)}{(3x^2+x)^2}$$

$$\frac{dy}{dx} = \frac{-9x^2 - \cancel{3x} - \{24x - 4 + 18x^2 + \cancel{3x}\}}{(3x^2+x)^2}$$

$$\boxed{\frac{dy}{dx} = \frac{9x^2 - 24x - 4}{(3x^2+x)^2}}$$

(19) $g(x) = \frac{x^2-4}{x+\frac{1}{2}}$

$$g'(x) = \frac{(x+\frac{1}{2})\frac{d}{dx}(x^2-4) - (x^2-4)\frac{d}{dx}(x+\frac{1}{2})}{(x+\frac{1}{2})^2}$$

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

$$g'(x) = \frac{2x^2 + x - x^2 + 4}{(x+0.5)^2}$$

$$\boxed{g'(x) = \frac{x^2 + x + 4}{(x+0.5)^2}}$$

Date ....

(20) $f(t) = \dfrac{t^2-1}{t^2+t-2}$

Sol:

$f(t) = \dfrac{t^2-1}{t^2+t-2}$

$f'(t) = \dfrac{(t^2+t-2)\frac{d}{dt}(t^2-1) - (t^2-1)\frac{d}{dt}(t^2+t-2)}{(t^2+t-2)^2}$

$f'(t) = \dfrac{(t^2+t-2)(2t) - (t^2-1)(2t+1)}{(t^2+t-2)^2}$

$f'(t) = \dfrac{\cancel{2t^3}+2t^2-4t-\cancel{2t^3}+2t-t^2+1}{(t^2+t-2)^2}$

$f'(t) = \dfrac{t^2-2t+1}{(t^2+t-2)^2}$

$f(t) = \dfrac{t^2-1}{t^2+t-2} \Rightarrow \dfrac{\cancel{(t-1)}(t+1)}{(t+2)\cancel{(t-1)}}$

$f(t) = \dfrac{t+1}{t+2}$

$f'(t) = \dfrac{(t+2)(1) - (t+1)(1)}{(t+2)^2}$

$f'(t) = \dfrac{\cancel{t}+2-\cancel{t}-1}{(t+2)^2}$

$\boxed{f'(t) = \dfrac{1}{(t+2)^2}}$

(21) $v = (1-t)(1+t^2)^{-1}$

$v = \dfrac{1-t}{1+t^2}$

$v' = \dfrac{(1+t^2)\frac{d}{dt}(1-t) - (1-t)\frac{d}{dt}(1+t^2)}{(1+t^2)^2}$

$v' = \dfrac{(1+t^2)(-1) - (1-t)(2t)}{(1+t^2)^2}$

$v' = \dfrac{-1-t^2-2t+2t^2}{(1+t^2)^2}$

$\boxed{v' = \dfrac{t^2-2t-1}{(1+t^2)^2}}$

(22) $w = (2x-7)^{-1}(x+5)$.

$w = \dfrac{x+5}{2x-7} \Rightarrow \dfrac{(2x-7)\frac{d}{dx}(x+5) - (x+5)\frac{d}{dx}(2x-7)}{(2x-7)^2}$

$w' = \dfrac{(2x-7)(1) - (x+5)(2)}{(2x-7)^2}$

$w' = \dfrac{\cancel{2x}-7-\cancel{2x}-10}{(2x-7)^2}$

$\boxed{w' = \dfrac{-17}{(2x-7)^2}}$

Date ....

(23) $f(s) = \dfrac{\sqrt{s}-1}{\sqrt{s}+1}$.

Sol,

Using Formula,

$$= \frac{(\sqrt{s}+1)\frac{d}{ds}(\sqrt{s}-1) - (\sqrt{s}-1)\frac{d}{ds}(\sqrt{s}+1)}{(\sqrt{s}+1)^2}$$

$= \because \frac{d}{ds}(\sqrt{s}) = \frac{1}{2\sqrt{s}}$

$$\frac{(\sqrt{s}+1)\left(\frac{1}{2\sqrt{s}}\right) - (\sqrt{s}-1)\left(\frac{1}{2\sqrt{s}}\right)}{(\sqrt{s}+1)^2}$$

$$= \frac{\cancel{\sqrt{s}} + \cancel{1} - \cancel{\sqrt{s}} + 1}{\cancel{2}\sqrt{s}(\sqrt{s}+1)^2}$$

$$\boxed{f'(s) = \frac{1}{\sqrt{s}(\sqrt{s}+1)^2}}.$$

(24) $u = \dfrac{5x+1}{2\sqrt{x}}$.

Sol.

Using Formula,

$$= \frac{(2\sqrt{x})\frac{d}{dx}(5x+1) - (5x+1)\frac{d}{dx}(2\sqrt{x})}{(2\sqrt{x})^2}$$

$$= \frac{(2\sqrt{x})(5) - (5x+1)\left(\frac{1}{\sqrt{x}}\right)}{4x}$$

$$\boxed{u' = \frac{5x-1}{4x^{3/2}}}.$$

(25) $v = \dfrac{1+x-4\sqrt{x}}{x}$.

$$v' = \frac{(x)\frac{d}{dx}(1+x-4\sqrt{x}) - (1+x-4\sqrt{x})\frac{d}{dx}(x)}{(x)^2}$$

$$v' = \frac{x\left(1-\frac{2}{\sqrt{x}}\right) - (1+x-4\sqrt{x})(1)}{x^2}$$

$$\boxed{v' = \frac{2\sqrt{x}-1}{x^2}}.$$

(26) $r = 2\left(\dfrac{1}{\sqrt{\theta}} + \sqrt{\theta}\right)$

$$r' = 2\left(\frac{\sqrt{\theta}(0) - (1)\left(\frac{1}{2\sqrt{\theta}}\right)}{\sqrt{\theta}} + \frac{1}{2\sqrt{\theta}}\right) \Rightarrow \boxed{r' = -\frac{1}{\theta^{3/2}} + \frac{1}{\theta^{1/2}}}$$

(27)

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

Sol,

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

$= (x^2-1)(x^2+x+1) + (x^2+x+1)(2x)$

$= 2x^3 + x^2 - 2x - 1 + 2x^3 + 2x^2$

$= 4x^3 + 3x^2 - 1$.

Date ....

(27) $y = \dfrac{1}{(x^2-1)(x^2+x+1)}$

Using Formula.

$y' = \dfrac{(x^2-1)(x^2+x+1)\frac{d}{dx}(1) - (1)\frac{d}{dx}(x^2-1)(x^2+x+1)}{[(x^2-1)(x^2+x+1)]^2}$

$y' = \dfrac{0 - 1(2x-0)(\cancel{2x+1}\ x^2+x+1)}{((x^2-1)(x^2+x+1))^2}$

$y' = -2x^3 - 2x^2 - 2x$

$u = 1$

$v = (x^2-1)(x^2+x+1)$

first we take v' (Product Rule).

$v' = (x^2-1)\frac{d}{dx}(x^2+x+1) + (x^2+x+1)\frac{d}{dx}(x^2-1)$

$v' = (x^2-1)(2x+1) + (x^2+x+1)(2x)$

$v' = 2x^3 + x^2 - \cancel{2x} - 1 + 2x^3 + 2x^2 + \cancel{2x}$

$v' = 6x^3 + 3x^2 - 1$

Rough Work

(27) $y = \dfrac{1}{(x^2-1)(x^2+x+1)}$

$y = \dfrac{1}{x^4+x^3+x^2-x^2-x-1}$

$y = \dfrac{1}{(x^4+x^3-x-1)}$

$y' = \dfrac{d}{dx}(x^4+x^3-x-1)^{-1}$

$y' = -(x^4+x^3-x-1)^{-2} \cdot \dfrac{d}{dx}(x^4+x^3-x-1)$

$y' = \dfrac{-1}{(x^4+x^3-x-1)^2}(4x^3+3x^2-1)$

$\boxed{y' = \dfrac{-4x^3-3x^2+1}{(x^2-1)^2(x^2+x+1)^2}}$

$\therefore (x^4+x^3-x-1) = (x^2-1)(x^2+x+1)$

Date ....

(27) $y = \dfrac{1}{(x^2-1)(x^2+x+1)}$

Sol: Done previously...

Using Product Rule:

$y' = (x^2-1)^{-1}(x^2+x+1)^{-1}$

$y' = (x^2-1)^{-1}\dfrac{d}{dx}(x^2+x+1)^{-1} + (x^2+x+1)^{-1}\dfrac{d}{dx}(x^2-1)^{-1}$

$y' = -(x^2-1)^{-1}(2x+1)^{-2}$ ...

(28) $y = \dfrac{(x+1)(x+2)}{(x-1)(x-2)}$

$y = \dfrac{x^2+3x+2}{x^2-3x+2}$

Using Formula:

$y' = \dfrac{(x^2-3x+2)\dfrac{d}{dx}(x^2+3x+2) + (x^2+3x+2)\dfrac{d}{dx}(x^2-3x+2)}{((x-1)(x-2))^2}$

$y' = \dfrac{(x^2-3x+2)(2x+3) + (x^2+3x+2)(2x-3)}{(x^2-3x+2)^2}$

$y' = \dfrac{2x^3 - \cancel{6x^2} + 4x + \cancel{3x^2} - 9x + \cancel{6} + 2x^3 + 6x^2 + \cancel{4x} - 3x^2 - 9x \mp \cancel{6}}{(x^2-3x+2)^2}$

$\boxed{y' = \dfrac{-6x^2+12}{(x-1)^2(x-2)^2}} = \boxed{\dfrac{-6(x^2+2)}{(x-1)^2(x-2)^2}}$

(29) $y = 2e^{-x} + e^{3x}$

$y' = 2\dfrac{d}{dx}e^{-x} + \dfrac{d}{dx}e^{3x}$

$y' = 2(-1)e^{-x} + 3e^{3x}$

$\boxed{y' = 3e^{3x} - 2e^{-x}}$

(30) $y = \dfrac{x^2+3e^x}{2e^x - x}$

Sol:

$y' = \dfrac{x^2+3e^x}{2e^x-x} = \dfrac{d}{dx}\left(\dfrac{x^2+3e^x}{2e^x-x}\right) = \dfrac{(2e^x-x)\dfrac{d}{dx}(x^2+3e^x) - (x^2+3e^x)\dfrac{d}{dx}(2e^x-x)}{(2e^x-x)^2}$

$y' = \dfrac{(2e^x-x)(2x+3e^x) - (x^2+3e^x)(2e^x-1)}{(2e^x-x)^2}$

$y' = \dfrac{4xe^x + 6e^{2x} - 2x^2 - 3xe^x - (2x^2e^x - x^2 + 6e^{2x} - 3e^x)}{(2e^x-x)^2}$

$y' = \dfrac{4xe^x + \cancel{6e^{2x}} - 2x^2 - 3xe^x - 2x^2e^x + x^2 - \cancel{6e^{2x}} + 3e^x}{(2e^x-x)^2}$

Date ....

$$\boxed{y' = \frac{xe^x - x^2 - 2x^2e^x + 3e^x}{(2e^x - x)^2}}$$

(31) $y = x^3e^x$

Using Formula,

$y' = (x^3)\frac{d}{dx}(e^x) + (e^x)\frac{d}{dx}(x^3)$

$y' = (x^3)(e^x) + (e^x)(3x^2)$

$\boxed{y' = x^3e^x + 3x^2e^x}$

(32) $w = re^{-r}$

Using Formula,

$w' = (r)\frac{d}{dr}(e^{-r}) + (e^{-r})\frac{d}{dr}(r)$

$w' = -(r)(e^{-r}) + (e^{-r})(1)$

$\boxed{w' = e^{-r} - re^{-r}}$.

(33) $y = x^{9/4} + e^{-2x}$

Using Formula,

$y' = \frac{d}{dx}(x^{9/4}) + \frac{d}{dx}(e^{-2x})$

$y' = \frac{9}{4}x^{5/4} + (-2)e^{-2x}$

$\boxed{y' = \frac{9}{4}x^{5/4} - 2e^{-2x}}$

(34) $y = x^{-3/5} + \pi^{3/2}$

Using Formula,

$y' = \frac{d}{dx}(x^{-3/5}) + \frac{d}{dx}(\pi^{3/2})$

$y' = -\frac{3}{5}x^{-8/5} + \cancel{\pi^{3/2}}(0)$

$\boxed{y' = \cancel{\pi^{3/2}} - \frac{3}{5}x^{-8/5}}$

(35) $s = 2t^{3/2} + 3e^2$

$s' = 2\frac{d}{dt}(t^{3/2}) + 3\frac{d}{dt}(e^2)$

$s' = \cancel{2}\left(\frac{3}{\cancel{2}}\right)t^{1/2} + 0$

$\boxed{s' = 3t^{1/2}}$

(36) $w = \frac{1}{z^{1.4}} + \frac{\pi}{\sqrt{z}}$

Sol

$w' = z^{-1.4} + \pi(z)^{-1/2}$

$w' = \frac{d}{dz}z^{-1.4} + \pi\frac{d}{dz}z^{-1/2}$

$w' = -\frac{1.4}{z^{2.4}} + \left(-\frac{1}{2}\right)\frac{\pi}{z^{3/2}}$

$\boxed{w' = -\frac{1.4}{z^{2.4}} - \frac{\pi}{2z^{3/2}}}$

$\frac{9}{9}-4$ $-\frac{3}{5}-5$ $\frac{2}{7}-1$ $-\frac{5}{7}$

Date ....

(37) $y = \sqrt[7]{x^2} - x^e$

Using Formula,

$y = (x^2)^{1/7} - x^e$

$y' = \frac{d}{dx} x^{2/7} - \frac{d}{dx} x^e$

$y' = \frac{2}{7} x^{-5/7} - ex$

(38) $y = \sqrt[3]{x^{9.6}} + 2e^{1.3}$

Using Formula,

$y' = (x)^{3/9.6} + 2e^{1.3}$

$y' = \frac{d}{dx}(x)^{3/9.6} + 2\frac{d}{dx} e^{1.3}$

$y' = \frac{3}{9.6}(x)^{2.2} + 0$

$\boxed{y' = 3.2x^{2.2}}$

(39) $r = \frac{e^s}{s}$

Sol

$\cancel{r = e^s \cdot s^{-1}}$

$\cancel{r = (e^s)\frac{d}{ds}(s^{-1}) + (s^{-1})\frac{d}{ds}(e^s)}$

Using Quotient Formula,

$r' = \frac{(s)\frac{d}{ds}(e^s) - (e^s)\frac{d}{ds}(s)}{(s)^2}$

$r' = \frac{s^1 e^s - e^s}{s^2}$

$\boxed{r' = \frac{e^s(s-1)}{s^2}}$

(40) $r = e^\theta\left(\frac{1}{\theta^2} + \theta^{-\pi/2}\right)$.

Using Product Rule.

$r = e^\theta\left(\frac{1}{\theta^2} + \theta^{-\pi/2}\right)$

$r = (e^\theta)\theta^{-\pi/2} + \frac{e^\theta}{\theta^2} - \frac{2e^\theta}{\theta^3} - \frac{\pi e^\theta}{2\theta^{\frac{\pi+2}{2}}}$

$\boxed{r = e^\theta \theta^{-\pi/2} + \frac{e^\theta}{\theta^2} - \frac{2e^\theta}{\theta^3} - \frac{\pi e^\theta}{2\theta^{\frac{\pi+2}{2}}}}$

$\longleftrightarrow$