Exercise 2.4

② 5, $f(t) = (at+b)(ct^2-d)$

$f'(t) = (a)(ct^2-d) + (at+b)(2ct)$

$f'(t) = \underline{act^2} - ad + \underline{2act^2} + 2bct$

$f'(t) = 3act^2 + 2bct - ad$

③ a) $y = (1-2x)(3x-4)$, $x=2$

① Find y' :

$y' = -2(3x-4) + (1-2x)(3)$

$y' = -6x+8 + 3 - 6x$

$y' = -12x+11$

② sub in $x=2$

$y' = -12x+11$

$y' = -12(2)+11$

$y' = -13$

$m = -13$

⑤ $y = (2-\sqrt{x})(1+\sqrt{x}+3x)$ @ $(1,5)$

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

① Find y' :

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

$y' = \left(\frac{-1}{2\sqrt{x}}\right)\left(1+\sqrt{x}+3x\right) + \left(2-\sqrt{x}\right)\left(\frac{1}{2\sqrt{x}}+3\right)$

② sub in $x=1$

$y' = \left(\frac{-1}{2\sqrt{1}}\right)\left(1+\sqrt{1}+3(1)\right) + \left(2-\sqrt{1}\right)\left(\frac{1}{2\sqrt{1}}+3\right)$

$y' = \left(\frac{-1}{2}\right)(5) + (1)\left(\frac{7}{2}\right)$

$y' = \frac{-5}{2} + \frac{7}{2} = \frac{2}{2} = 1$

$m = 1$

③ $y - y_1 = m(x-x_1)$

$y - 5 = 1(x-1) \cdots$

$y - 5 = x - 1$

$y = x + 4$

or $x - y + 4 = 0$

Exercise 2.4

2 h) $g(v) = (v - \sqrt{v})(v^2 + \sqrt[3]{v})$

$$g(v) = \underbrace{(v - v^{1/2})}_{f(x)}\underbrace{(v^2 + v^{1/3})}_{g(x)}$$

$\begin{aligned} &1 + (-\tfrac{1}{2}) \\ &\tfrac{2}{2} + (-\tfrac{1}{2}) \end{aligned}$

$\begin{aligned} &-\tfrac{1}{2} + \tfrac{2}{1} \\ &-\tfrac{1}{2} + \tfrac{4}{2} \end{aligned}$

$$g'(v) = \left(1 - \tfrac{1}{2}v^{1/2}\right)(v^2 + v^{1/3}) + (v - v^{1/2})\left(2v + \tfrac{1}{3}v^{-1/3}\right)$$

$$g'(v) = v^2 + v^{1/3} - \tfrac{1}{2}v^{3/2} - \tfrac{1}{2}v^0 + 2v^2 + \tfrac{1}{3}v^{1/3} - 2v^{3/2} - \tfrac{1}{3}v^0$$

$$g'(v) = \tfrac{3v^2}{1} - \tfrac{5}{2}v^{3/2} + \tfrac{3}{2}v^{1/3} - \tfrac{1}{1}$$

$$g'(v) = \tfrac{6v^2}{2} - \tfrac{5v^{3/2}}{2} + \tfrac{3v^{1/3}}{2} - \tfrac{2}{2}$$

$$g'(v) = \frac{6v^2 - 5v^{3/2} + 3v^{1/3} - 2}{2}$$

Product Rule:

$$(f \cdot g)'(x) = f'(x)g(x) + f(x)g'(x)$$

2 g) $g(u) = \sqrt{u}\,(2 - u^2 + 5u^4)$

$$g(u) = \underbrace{u^{1/2}}_{f(x)}\underbrace{(2 - u^2 + 5u^4)}_{g(x)}$$

$$g'(u) = \tfrac{1}{2}u^{-1/2}(2 - u^2 + 5u^4) + u^{1/2}(-2u + 20u^3)$$

$$g'(u) = u^{-1/2} - \tfrac{1}{2}u^{3/2} + \tfrac{5}{2}u^{7/2} - 2u^{3/2} + 20u^{7/2}$$

$$g'(u) = \tfrac{45}{2}u^{7/2} - \tfrac{5}{2}u^{3/2} + u^{-1/2}$$

$$g'(u) = \tfrac{45}{2}u^{7/2} - \tfrac{5}{2}u^{3/2} + \frac{1}{u^{1/2}}$$

$$g(u) = u^{1/2}(2 - u^2 + 5u^4)$$

$$g(u) = 2u^{1/2} - u^{5/2} + 5u^{9/2}$$

$$g'(u) = u^{-1/2} - \tfrac{5}{2}u^{3/2} + \tfrac{45}{2}u^{7/2}$$

$$g'(u) = \tfrac{45}{2}u^{7/2} - \tfrac{5}{2}u^{3/2} + \frac{1}{u^{1/2}}$$

Exercise 2.4

⑤ $y = (2 - \sqrt{x})(1 + \sqrt{x} + 3x)$ @ $(1, 5)$

① Find derivative

$$y = \underbrace{(2 - x^{1/2})}_{f(x)}\underbrace{(1 + x^{1/3} + 3x)}_{g(x)}$$

$$y' = \underbrace{\left(-\frac{1}{2}x^{-1/2}\right)}_{f'(x)}\underbrace{(1 + \sqrt{x} + 3x)}_{g(x)} + \underbrace{(2 - \sqrt{x})}_{f(x)}\underbrace{\left(\frac{1}{2}x^{-1/2} + 3\right)}_{g'(x)}$$

$$y' = \left(\frac{-1}{2\sqrt{x}}\right)(1 + \sqrt{x} + 3x) + (2 - \sqrt{x})\left(\frac{1}{2\sqrt{x}} + 3\right)$$

② Solve for slope of tangent (m)

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

$$m = y'(1) = \frac{-5}{2} + 1\left(\frac{1}{2} + \frac{6}{2}\right)$$

$$m = y'(1) = \frac{-5}{2} + \frac{7}{2} = \frac{2}{2} = 1 \quad \overleftarrow{\quad} m = 1$$

③ Find the equation

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

$$y - 5 = 1(x - 1)$$

$$y - 5 = x - 1$$

$$y = x + 4 \quad \checkmark$$

$$\boxed{0 = x - y + 4} \quad \checkmark$$

Exercise 2.4

⑥ If:

Find $(fg)'(2)$ · multiply · Product Rule

$f(2) = 3$
$f'(2) = 5$
$g(2) = -1$
$g'(2) = -4$

$$(fg)'(x) = f'(x)g(x) + f(x)g'(x)$$

$$(fg)'(2) = f'(2)g(2) + f(2)g'(2)$$

$$(fg)'(2) = (5)(-1) + (3)(-4)$$

$$(fg)'(2) = -5 - 12$$

$$(fg)'(2) = -17$$

Exercise 2.5

④ If:

Find $\left(\dfrac{f}{g}\right)'(2)$ · Division · (Quotient Rule)

$f(2) = 3$
$f'(2) = 5$
$g(2) = -1$
$g'(2) = -4$

$$\left(\frac{f}{g}\right)'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

$$\left(\frac{f}{g}\right)'(2) = \frac{f'(2)g(2) - f(2)g'(2)}{[g(2)]^2}$$

$$\left(\frac{f}{g}\right)'(2) = \frac{(5)(-1) - (3)(-4)}{(-1)^2}$$

$$\left(\frac{f}{g}\right)'(2) = \frac{-5 + 12}{1}$$

$$\boxed{\left(\frac{f}{g}\right)'(2) = 7}$$

Differentiation Rules

Product Rule:

The Product Rule If f and g are both differentiable, then

$$\frac{d}{dx}[f(x)g(x)] = f(x)\frac{d}{dx}[g(x)] + g(x)\frac{d}{dx}[f(x)]$$

Express the product rule verbally if you are considering a function of the form...

$f(x) = $ (First) X (Second)

In words, **the Product Rule** says that the **derivative of a product of two functions is:** **the derivative of the first function times the second function, plus the first function times the derivative of the second function**

Get in the habit of verbalizing the rule as you differentiate...it will help when the functions get more complicated.

$$\left(\frac{f}{g}\right)'x = f'(x)g(x) + f(x)g'(x)$$

Differentiate the following function and simplify your answer:

$$h(t) = \underset{f(x)}{\underbrace{(t^3 - 5t)}}\ \underset{g(x)}{\underbrace{(6\sqrt{t} - t^{-5})}}$$

$$h'(t) = (3t^2 - 5)(6t^{1/2} - t^{-5}) + (t^3 - 5t)(3t^{-1/2} + 5t^{-6})$$

$$h'(t) = 18t^{5/2} - 3t^{-3} - 30t^{1/2} + 5t^{-5} + 3t^{5/2} + 5t^{-3} - 15t^{1/2} - 25t^{-5}$$

$$h'(t) = 21t^{5/2} - 45t^{1/2} + 2t^{-3} - 20t^{-5}$$

$$\boxed{h'(t) = 21t^{5/2} - 45t^{1/2} + \frac{2}{t^3} - \frac{20}{t^5}}$$

Quotient Rule:

The Quotient Rule   If f and g are differentiable, then

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)\dfrac{d}{dx}[f(x)] - f(x)\dfrac{d}{dx}[g(x)]}{[g(x)]^2}$$

Express the quotient rule verbally if you are considering a function of the form...

$$f(x) = \frac{\text{(First)}}{\text{(Second)}}$$

In words, **the Quotient Rule** says that the **derivative of a quotient is:**
the denominator times the derivative of the numerator, minus the numerator times the derivative of the denominator, all divided by the square of the denominator.

$$\left(\frac{f}{g}\right)'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$$

Examples: $\left(\dfrac{f}{g}\right)'(x) = \dfrac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$

Differentiate the following functions and simplify your answers:

$$F(x) = \frac{x^2 + 2x - 3}{x^3 + 1} \quad \begin{array}{l} f(x) \\ g(x) \end{array}$$

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

$$F'(x) = \frac{2x^4 + 2x + 2x^3 + 2 - 3x^4 - 6x^3 + 9x^2}{(x^3+1)^2}$$

$$F'(x) = \frac{-x^4 - 4x^3 + 9x^2 + 2x + 2}{(x^3+1)^2}$$

$$F(x) = \frac{\sqrt{x}}{1+2x} \quad \begin{array}{l} f(x) \\ g(x) \end{array} \quad = \frac{x^{1/2}}{1+2x}$$

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

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

$$F'(x) = \frac{\frac{2\sqrt{x}}{2\sqrt{x}}\cdot\frac{1+2x}{2\sqrt{x}} - 2\sqrt{x}\cdot 2\sqrt{x}}{2\sqrt{x}(1+2x)^2} \qquad \text{CD: } 2\sqrt{x}$$

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

Differentiate the following functions, do not simplify your answers:

$$f(x) = \frac{8 - 9x^7}{3x - 7}$$

$$f'(x) = \frac{-63x^6(3x-7) - 3(8-9x^7)}{(3x-7)^2}$$

$$f(x) = \frac{x^3 - 7x^2 + 2}{x^8 - 4x^5}$$

$$f'(x) = \frac{(3x^2-14x)(x^8-4x^5) - (x^3-7x^2+2)(8x^7-20x^4)}{(x^8-4x^5)^2}$$

Exercise 2.5

Complex Fraction

① b) $f(x) = \dfrac{1 - \frac{1}{x}}{x(x+1)}$ CD: x

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

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

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

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

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

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

Exercise 2.5

② a) $f(x) = \dfrac{2+x}{1-2x}$ ← linear ↗ $\{x \mid x \in R\}$

← linear $\{x \mid x \in R\}$

Non permissible values: (Cannot divide by 0)

$1-2x \neq 0$

$\dfrac{1}{2} \neq \dfrac{2x}{2}$

$\dfrac{1}{2} \neq x$

Domain: $\{x \mid x \neq \tfrac{1}{2}, x \in R\}$ Set Notation

Domain: $(-\infty, \tfrac{1}{2}) \cup (\tfrac{1}{2}, \infty)$ Interval Notation

Exercise 2.5

③ c) $y = \dfrac{1}{x^2+1}$, $\left(-2, \dfrac{1}{5}\right)$ $x_1 = -2$

$y_1 = \dfrac{1}{5}$

(i) Find $\dfrac{dy}{dx}$

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

$\dfrac{dy}{dx} = \dfrac{(0)(x^2+1) - (1)(2x)}{(x^2+1)^2}$

$\dfrac{dy}{dx} = \dfrac{-2x}{(x^2+1)^2}$

(ii) Find slope

$\dfrac{dy}{dx} = \dfrac{-2x}{(x^2+1)^2}$

$\dfrac{dy}{dx} = \dfrac{-2(-2)}{\left[(-2)^2+1\right]^2}$

$\boxed{\dfrac{dy}{dx} = \dfrac{4}{25}}$ Slope "m"

(iii) Find equation:

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

$y - \dfrac{1}{5} = \dfrac{4}{25}\left(x - (-2)\right)$

$y - \dfrac{1}{5} = \dfrac{4}{25}(x+2)$

$y - \dfrac{1}{5} = \dfrac{4x}{25} + \dfrac{8}{25}$

$y = \dfrac{4}{25}x + \dfrac{8}{25} + \dfrac{1}{5}$

$y = \dfrac{4}{25}x + \dfrac{8}{25} + \dfrac{5}{25}$

$\boxed{y = \dfrac{4}{25}x + \dfrac{13}{25}}$ ✓

$0 = \dfrac{4}{25}x - y + \dfrac{13}{25}$

$\boxed{0 = 4x - 25y + 13}$

Homework

Exercise 2.5

$\left(\dfrac{f}{g}\right)'(x) = \dfrac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$

① d)

$g(x) = \dfrac{x^3-1}{x^2+x+1}$ $\begin{array}{l}f(x)\\g(x)\end{array}$

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

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

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

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

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

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

$\boxed{g'(x) = 1}$

Exercise 2.5

① b)　$f(x) = \dfrac{x \cdot 1 - \frac{1}{x} \cdot x}{(x+1)x}$

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

$f(x) = \dfrac{1 - \frac{1}{x}}{x+1}$

$f(x) = \dfrac{\frac{x}{x} - \frac{1}{x}}{x+1}$

$f(x) = \dfrac{\frac{x-1}{x}}{x+1}$

$f(x) = \dfrac{x-1}{x} \cdot \dfrac{1}{x+1}$

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

Exercise 2.5

③a)　$y = \dfrac{x}{x-2}$　　　$(4, 2)$

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

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

③ $y - y_1 = m(x - x_1)$

$y - 2 = -\dfrac{1}{2}(x - 4)$

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

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

Exercise 2.5

③ Find an <u>equation</u> of the <u>tangent line to</u> the curve at the given point.

c) $y = \dfrac{1}{x^2+1}$, $(-2, \frac{1}{5})$ $x_1 = -2$

$y_1 = \frac{1}{5}$

(i) Find the derivative.

$y = \dfrac{1 \overset{f(x)}{}}{x^2+1 \underset{g(x)}{}}$ ← division

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

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

(ii) Sub in x-value to find m

$y'(-2) = \dfrac{-2(-2)}{((-2)^2+1)^2} = \boxed{\dfrac{4}{25}}\, m$

(iii) Find the equation of the tangent line

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

$y - \dfrac{1}{5} = \dfrac{4}{25}(x + 2)$

$y - \dfrac{1}{5} = \dfrac{4}{25}x + \dfrac{8}{25}$

$y = \dfrac{4}{25}x + \dfrac{8}{25} + \dfrac{1}{5}$

$y = \dfrac{4}{25}x + \dfrac{8}{25} + \dfrac{5}{25}$

$\boxed{y = \dfrac{4}{25}x + \dfrac{13}{25}}$ ✓

$25y = 4x + 13$

$\boxed{0 = 4x - 25y + 13}$ ✓

Exercise 2.5

③ d) $y = \dfrac{x^3 - 1}{1 + 2x^2}$, $(1, 0)$

x_1, y_1

(I) Find derivative

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

$y' = \dfrac{3x^2 + 6x^4 - 4x^4 + 4x}{(1 + 2x^2)^2}$

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

(II) Find m (sub in x=1)

$m = y'(1) = \dfrac{2(1)^4 + 3(1)^2 + 4(1)}{[1 + 2(1)^2]^2}$

$m = y'(1) = \dfrac{2 + 3 + 4}{9} = \dfrac{9}{9} = 1$

$\uparrow$
m

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

$y - 0 = 1(x - 1)$

$\boxed{y = x - 1}$

$\boxed{x - y - 1 = 0}$

Exercise 2.5

(#6)   slope of the tangent equals $\underline{0}$ (horizontal)

① Find derivative:

$y = \dfrac{x^2}{2x+5}$ $f(x)$
              $g(x)$

$y' = \dfrac{2x(2x+5) - x^2(2)}{(2x+5)^2}$

$y' = \dfrac{4x^2 + 10x - 2x^2}{(2x+5)^2}$

$y' = \dfrac{2x^2 + 10x}{(2x+5)^2}$

② Solve for x.

$y' = \dfrac{2x^2 + 10x}{(2x+5)^2}$

$(2x+5)^2 \dfrac{0}{1} = \dfrac{2x^2+10x}{(2x+5)^2} (2x+5)^2$

$0 = 2x^2 + 10x$

$0 = 2x(x+5)$

$2x = 0$ | $x + 5 = 0$
$x = 0$ | $x = -5$

③ Solve for y:

if x=0

$y = \dfrac{x^2}{2x+5}$

$y = \dfrac{(0)^2}{2(0)+5} = \dfrac{0}{5} = 0$

$(0,0)$

if x=-5

$y = \dfrac{x^2}{2x+5}$

$y = \dfrac{(-5)^2}{2(-5)+5} = \dfrac{25}{-5} = -5$

$(-5,-5)$

Review to Date:

① a) $f(x) = 2x^3 + 3x$　　① $f(x+h) = 2(x+h)^3 + 3(x+h)$

$$f(x+h) = 2(x^3 + 3x^2h + 3xh^2 + h^3) + 3(x+h)$$

$$f(x+h) = 2x^3 + 6x^2h + 6xh^2 + 2h^3 + 3x + 3h$$

② $f'(x) = \lim\limits_{h \to 0} \dfrac{2x^3 + 6x^2h + 6xh^2 + 2h^3 + 3x + 3h - (2x^3 + 3x)}{h}$

$$f'(x) = \lim\limits_{h \to 0} \dfrac{6x^2h + 6xh^2 + 2h^3 + 3h}{h}$$

$$f'(x) = \lim\limits_{h \to 0} \dfrac{h(6x^2 + 6xh + 2h^2 + 3)}{h} = 6x^2 + 3$$

Review to Date:

② e) $f(x) = 6x\sqrt{x^3} - 2(\sqrt[3]{x})$

$f(x) = 6x^1(x^{3/2}) - 2x^{1/3}$

$f(x) = 6x^{5/2} - 2x^{1/3}$

$f'(x) = 15x^{3/2} - \dfrac{2}{3}x^{-2/3}$

$f'(x) = 15x^{3/2} - \dfrac{2}{3x^{2/3}}$

$6 \cdot \dfrac{5}{2} = \dfrac{30}{2} = 15$

$-2 \cdot \dfrac{1}{3} = \dfrac{-2}{3}$

⑤ b) $f(x) = \dfrac{x+3}{4-x^2} \quad \begin{matrix} f(x) \\ g(x) \end{matrix}$

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

$f'(x) = \dfrac{4-x^2 + 2x^2 + 6x}{(4-x^2)^2} = \dfrac{x^2 + 6x + 4}{(4-x^2)^2}$

Review to Date:

③ $y = x^3 + 3x$ $x = \underline{1}$ Equation of tangent

(i) Find y

$y = (1)^3 + 3(1)$

$y = 4$

(ii) Find the derivative

$y = x^3 + 3x$

$y' = 3x^2 + 3$

(iii) Find m:

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

$y'(1) = 6$

$m = 6$

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

$y - 4 = 6(x - 1)$

$y - 4 = 6x - 6$ $^{+4}$

$\boxed{y = 6x - 2}$

$\boxed{0 = 6x - y - 2}$

Review to Date: $(f \cdot g)'(x) = f'(x)g(x) + f(x)g'(x)$

④ c) $f(x) = \sqrt[3]{x^2}\left(x^4 - 5\sqrt[3]{x^5}\right)$

$f(x) = x^{2/3}\left(x^4 - 5x^{5/3}\right)$

$f'(x) = \dfrac{2}{3}x^{-1/3}\left(x^4 - 5x^{5/3}\right) + x^{2/3}\left(4x^3 - \dfrac{25}{3}x^{2/3}\right)$

$f'(x) = \boxed{\dfrac{2}{3}x^{11/3}} \boxed{-\dfrac{10}{3}x^{4/3}} \boxed{+4x^{11/3}} \boxed{-\dfrac{25}{3}x^{4/3}}$

$f'(x) = \dfrac{14}{3}x^{11/3} - \dfrac{35}{3}x^{4/3}$

$-\dfrac{1}{2}x^{-1/2}$

$3(2) = 6$
$2(3) = 6$

⑤ c) $g(x) = \dfrac{7\sqrt{x} - 10}{1 - \sqrt{x}} = \dfrac{7x^{1/2} - 10}{1 - x^{1/2}}$ $f(x)$ / $g(x)$

$g'(x) = \dfrac{\dfrac{7}{2}x^{-1/2}\left(1 - x^{1/2}\right) + \dfrac{1}{2}x^{-1/2}\left(7x^{1/2} - 10\right)}{\left(1 - \sqrt{x}\right)^2}$

$g'(x) = \dfrac{\dfrac{7}{2x^{1/2}}\left(1 - x^{1/2}\right) + \dfrac{1}{2x^{1/2}}\left(7x^{1/2} - 10\right) \cdot 2x^{1/2}}{2x^{1/2}\left(1 - \sqrt{x}\right)^2}$

$g'(x) = \dfrac{7\left(1 - x^{1/2}\right) + 1\left(7x^{1/2} - 10\right)}{2x^{1/2}\left(1 - \sqrt{x}\right)^2}$

$g'(x) = \dfrac{7 - 7x^{1/2} + 7x^{1/2} - 10}{2\sqrt{x}\left(1 - \sqrt{x}\right)^2} = \dfrac{-3}{2\sqrt{x}\left(1 - \sqrt{x}\right)^2}$

$$Ex \quad f(x) = 5x^3 + \frac{3}{x^2} - 2$$

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

$$f'(x) = 15x^2 - 6x^{-3} - 0$$

$$f'(x) = 15x^0 - \frac{6}{x^3}$$

Review to Date :

④ c) $f(x) = x^{2/3}(x^4 - 5x^{5/3})$ Power Rule

$$f(x) = x^{\frac{14}{3}} - 5x^{\frac{7}{3}}$$

$$f'(x) = \frac{14}{3} x^{\frac{11}{3}} - \frac{35}{3} x^{\frac{4}{3}}$$

④ d) $f(x) = (x^2 - 3x + 4)(2x^2 + 4x)$

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

$$f'(x) = 4x^3 + 8x^2 - 6x^2 - 12x + 4x^3 - 12x^2 + 16x + 4x^2 - 12x + 16$$

$$f'(x) = 8x^3 - 6x^2 - 8x + 16$$

$$f'(x) = 2(4x^3 - 3x^2 - 4x + 8) \quad *$$

$$6x - y = 4$$

$$6x - 4 = y$$

$$y = 6x - 4$$

$$m = 6$$

$$y = x\sqrt{x} = x(x^{1/2}) = x^{3/2}$$

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

$$6 = \frac{3}{2}x^{1/2}$$

$$12 = 3x^{1/2}$$

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

$$16 = x$$

① $f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

⑤ $y - y_1 = m(x - x_1)$

$(x+h)^3$

$x^3 + 3x^2h + 3xh^2 + h^3$