

$$v = x^{12} - x^5$$

3.3 f g

$$(23) \frac{d}{dx}(uv) = u'v + v'u$$

$$(-3)(-1) + 2(5)$$

$$3 + 10 = (13)$$

~~$$\begin{array}{r} 3x^2 \\ \times 2x \\ \hline 6x^3 \end{array}$$~~

$$3 \cdot \underline{2x}$$

$$6x$$

$$\frac{d}{dx}(7v - 2u) = 7v' - 2u'$$

$$7(2) - 2(-3)$$

$$14 + 6 = (20)$$

(27) $y = \frac{x^3 + 1}{2x}$ f g, $x = 1$

$$y(1) = \frac{1^3 + 1}{2(1)} = 1$$

$$m = \frac{1}{2}, (1, 1)$$

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

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

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

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

$$x^{-4} \leftarrow \frac{1}{x^4}$$

(31) $y = \frac{\sqrt{x} - 1}{\sqrt{x} + 1} = \frac{x^{1/2} - 1}{x^{1/2} + 1}$ f g

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

~~$$\begin{array}{r} 4x^3 \\ \times 3 \\ \hline 12x^3 \end{array}$$~~

$$y' = \frac{\frac{1}{2}x^{-1/2}[\cancel{x^{1/2} + 1} - \cancel{x^{1/2} - 1}]}{(x^{1/2} + 1)^2} = \frac{1}{2} \neq \frac{1}{x^{1/2}(x^{1/2} + 1)^2}$$

3.3

$$\begin{aligned} \textcircled{37} \quad y &= x^3 - 3x + 1 \\ y' &= 3x^2 - 3 \\ y'(2) &= 3(2)^2 - 3 = 9 \end{aligned}$$

$$\begin{aligned} m &= -\frac{1}{9}, (2, 3) \\ y - y_1 &= m(x - x_1) \\ y - 3 &= -\frac{1}{9}(x - 2) \end{aligned}$$

$$\begin{aligned} \textcircled{19} \quad y &= \frac{(x-1)(x^2+x+1)}{x^3} \\ y &= \frac{x^3-1}{x^3} \end{aligned}$$

$$\begin{array}{r} (x-1)(x^2+x+1) \\ x^3+x^2+x \\ \hline -x^2-x-1 \\ x^3-1 \end{array}$$

$$y = \frac{x^3}{x^3} - \frac{1}{x^3}$$

$$y = 1 - x^{-3}$$

$$y' = 3x^{-4}$$

$$\begin{aligned} \textcircled{48} \quad R &= m^2 \left(\frac{c}{2} - \frac{m}{3} \right) \\ &= \frac{c}{2} m^2 - \frac{1}{3} m^3 \end{aligned}$$

$$\frac{dR}{dm} \quad \frac{dy}{dx}$$

$$\frac{dR}{dm} = cm - m^2$$

$$m^2 \left(\frac{c}{2} - \frac{m}{3} \right)$$

$$2m \left(\frac{c}{2} - \frac{m}{3} \right) + \frac{-1}{3} (m^2)$$

3.3

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

$(2, 3), m = -\frac{1}{9}$

$y' = 3x^2 - 3$

$y'(2) = 3(2)^2 - 3 = 9$

$y - y_1 = m(x - x_1)$
 $y - 3 = -\frac{1}{9}(x - 2)$

(27) $y = \frac{x^3 + 1}{2x}, x = 1$

$y(1) = \frac{1^3 + 1}{2(1)} = \frac{2}{2} = 1$

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

$(1, 1)$

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

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

(31) $y = \frac{\sqrt{x-1}}{\sqrt{x+1}} = \frac{x^{1/2} - 1}{x^{1/2} + 1}$
 $y' = \frac{\frac{1}{2}x^{-1/2}[x^{1/2} + 1] - \frac{1}{2}x^{-1/2}[x^{1/2} - 1]}{(x^{1/2} + 1)^2}$

$\frac{1}{2}x^{-1/2} \cdot x^{1/2} = 2x^0 = 2$
 $\frac{1}{2}x^{-1/2} \cdot x^2 = \frac{1}{2}x^{3/2}$

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

$(3+4)^2 = 3^2 + 4^2$

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

$$u(0) = 5 \quad v(0) = -1$$

$$u'(0) = -3 \quad v'(0) = 2$$

3.3

(23) $\frac{d}{dx}(uv) = u'v + v'u$

(a) $(-3)(-1) + (2)(5)$

$$3 + 10 = \boxed{13}$$

(d) $\frac{d}{dx}(7v - 2u) = 7v' - 2u'$

$$= 7(2) - 2(-3)$$

$$= 14 + 6 = \boxed{20}$$

$$y = x^3 - 3x + 10$$

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

(51) PRODUCTION = TREES \cdot YIELD

$$\text{INCREASE IN PRODUCTION} = \left(\begin{array}{l} \text{RATE OF CHANGE} \\ \text{IN TREES} \end{array} \right) (\text{YIELD}) + \left(\begin{array}{l} \text{RATE OF CHANGE} \\ \text{IN YIELD} \end{array} \right) (\text{TREES})$$

$$= (13)(12) + (1.5)(156)$$

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

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

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

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

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

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

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

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

3.3

(32)

$$\frac{d}{dx} = 2\sqrt{x} - \frac{1}{\sqrt{x}} = 2x^{1/2} - x^{-1/2}$$

$$= x^{-1/2} + \frac{1}{2}x^{-3/2} \quad \blacktriangleleft$$

$$= \frac{1}{\sqrt{x}} + \frac{1}{2\sqrt{x^3}} \quad \text{OR} \quad \frac{1}{\sqrt{x}} + \frac{1}{2x\sqrt{x}}$$

3.3

$$\textcircled{10} \quad y = 4x^3 - 6x^2 - 1$$

$$y' = 12x^2 - 12x = 0$$

$$12x(x-1) = 0$$

$$12x = 0 \quad x - 1 = 0$$

$$x = 0$$

$$x = 1$$