

1. $-3x^2 \csc(x^3) \cot(x^3)$

2. $\frac{2xe^{\tan^{-1}(x^2)}}{1+x^4}$

3. $\pi(\cos^2(\pi x) - \sin^2(\pi x)) = \pi \cos(2\pi x)$

4. $\frac{-t^4 + 3t^2 + 2t}{(t^3 + 1)^2}$

5. $\frac{-25 \ln x}{x^6}$

6. $20(x+1)(x^2 + 2x + 4)^9$

7. $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{[3(x+h)^2 + 4(x+h)] - [3x^2 + 4x]}{h}$

$$= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 + 4x + 4h - 3x^2 - 4x}{h} = \lim_{h \rightarrow 0} \frac{6xh + 3h^2 + 4h}{h}$$

$$= \lim_{h \rightarrow 0} [6x + 3h + 4] = 6x + 4$$

Power rule is $\frac{d}{dx} x^k = kx^{k-1}$. $\frac{d}{dx}(3x^2 + 4x) = \frac{d}{dx}(3x^2) + \frac{d}{dx}(4x) = 6x + 4$

8. $(\sin t)' [\ln \sin t + t \cot t]$

9. (a) -42 m/s (b) $\sqrt{2} \text{ sec}$ (c) $s(t) = 2t^2 - \frac{t^4}{2}$

10. (a) incr $(0, 2)$ decr $(-\infty, 0)$ and $(2, \infty)$ (b) max $f(2) = \frac{4}{e^2}$ min $f(0) = 0$

(c) conc up $(-\infty, 2 - \sqrt{2})$ $(2 + \sqrt{2}, \infty)$ conc down $(2 - \sqrt{2}, 2 + \sqrt{2})$

(d) vertical asymptote: none (domain is all real numbers)

horizontal asymptote: $y = 0$ (the limit of the function as $x \rightarrow \infty$)

11. height: $\frac{2\sqrt{3}}{3} \text{ ft}$ radius: $\frac{\sqrt{6}}{3} \text{ ft}$

12.

(a) $x_{n+1} = x_n - \frac{x_n^2 - 2}{2x_n} = \frac{x_n^2 + 2}{2x_n}$

(b) $x_1 = \frac{3}{2}$ $x_2 = \frac{17}{12} \approx 1.416667$