

1. 1F-1

(a)

$$f'(x) = 4x^3 + 8x$$

(b)

$$f'(x) = 200x(x^2 + 2)^{99}$$

2. 1F-2

$$\begin{aligned} f'(x) &= x^9(x^2 + 1)^{10} + 20x^{11}(x^2 + 1)^9 \\ &= x^9(x^2 + 1)^9((x^2 + 1) + 20x^2) \\ &= x^9(x^2 + 1)^9(21x^2 + 1) \end{aligned}$$

3. 1F-3 if n is constant:

$$f' = \frac{1}{n} x^{\frac{1-n}{n}}$$

4. 1F-4

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

$$\begin{aligned} y' &= 3(1 - x^{\frac{1}{3}})^2 \\ &= 3(1 - x^{\frac{1}{3}})^2 \\ &= x^{-\frac{2}{3}}(1 - x^{\frac{1}{3}})^2 \end{aligned}$$

5. 1F-6 if f(x) is even, $f(x) = f(-x)$:

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

$$\begin{aligned} f'(-x) &= \lim_{\Delta x \rightarrow 0} \frac{f(-x + \Delta x) - f(-x)}{\Delta x} \\ &= \lim_{\Delta x \rightarrow 0} \frac{f(-x + \Delta x) - f(x)}{\Delta x} \\ &= \lim_{\Delta x \rightarrow 0} \frac{f(-(x - \Delta x)) - f(x)}{\Delta x} \\ &= \lim_{\Delta x \rightarrow 0} \frac{f(x - \Delta x) - f(x)}{\Delta x} \end{aligned}$$

6. 1F-7

(a)

$$\frac{dD}{dx} = [(x-a)^2 + y0^2]^{-\frac{1}{2}}(x-a)$$

(b)

$$\begin{aligned}\frac{dm}{dv} &= -\frac{1}{2}\left(1 - \frac{v^2}{c^2}\right)^{-\frac{3}{2}}\left(-\frac{2}{c^2}v\right) \\ &= \frac{m0}{c^2}\left(1 - \frac{v^2}{c^2}\right)^{-\frac{3}{2}}v\end{aligned}$$

(c)

$$\begin{aligned}\frac{dF}{dr} &= (mg(1+r^2)^{-\frac{3}{2}})' \\ &= 3mg(1+r^2)^{-\frac{5}{2}}r\end{aligned}$$

(d)

$$\frac{dQ}{dt} = a(1+bt^2)^{-3}[1-3bt^2(1+bt^2)^{-1}]$$