

The following examples were taken from Michael Spivak's excellent book, titled "Calculus". This is from page 165.

The following statements use Leibniz notation. Re-state them, using Newton notation.

$$1. \frac{dx^n}{dx} = nx^{n-1}$$

$$2. \frac{dz}{dy} = -\frac{1}{y^2} \text{ if } z = \frac{1}{y}$$

$$3. \frac{d[f(x) + c]}{dx} = \frac{df(x)}{dx}$$

$$4. \frac{d[cf(x)]}{dx} = c \frac{df(x)}{dx}$$

$$5. \frac{dz}{dx} = \frac{dy}{dx} \text{ if } z = y + c$$

$$6. \left. \frac{dx^3}{dx} \right|_{x=a^2}$$

$$7. \left. \frac{df(x+a)}{dx} \right|_{x=b} = \left. \frac{df(x)}{dx} \right|_{x=b+a}$$

$$8. \left. \frac{df(cx)}{dx} \right|_{x=b} = c \cdot \left. \frac{df(x)}{dx} \right|_{x=cb}$$

$$9. \frac{df(cx)}{dx} = c \cdot \left. \frac{df(y)}{dy} \right|_{y=cx}$$

$$10. \frac{d^k x^n}{dx^k} = k! \binom{n}{k} x^{n-k}$$

Answers

1. $\frac{dx^n}{dx} = nx^{n-1}$ is the same as: If $f(x) = x^n$, then $f'(x) = nx^{n-1}$
2. $\frac{dz}{dy} = -\frac{1}{y^2}$ if $z = \frac{1}{y}$ is the same as: If $f(y) = \frac{1}{y}$, then $f'(y) = -\frac{1}{y^2}$
3. $\frac{d[f(x) + c]}{dx} = \frac{df(x)}{dx}$ is the same as $(f(x) + c)' = f'(x)$
4. $\frac{d[cf(x)]}{dx} = c \frac{df(x)}{dx}$ is the same as $(cf(x))' = cf'(x)$
5. $\frac{dz}{dx} = \frac{dy}{dx}$ if $z = y + c$ is the same as $z' = y'$ if $z = y + c$
6. $\left. \frac{dx^3}{dx} \right|_{x=a^2}$ is the same as: If $f(x) = x^3$, then $f'(a^2) = 3a^4$
7. $\left. \frac{df(x+a)}{dx} \right|_{x=b} = \left. \frac{df(x)}{dx} \right|_{x=b+a}$ is the same as : If $g(x) = f(x+a)$, then $g'(b) = f'(b+a)$
8. $\left. \frac{df(cx)}{dx} \right|_{x=b} = c \cdot \left. \frac{df(x)}{dx} \right|_{x=cb}$ is the same as: If $g(x) = f(cx)$, then $g'(b) = c \cdot f'(cb)$
9. $\frac{df(cx)}{dx} = c \cdot \left. \frac{df(y)}{dy} \right|_{y=cx}$ is the same as: If $g(x) = f(cx)$, then $g'(x) = cf'(cx)$
10. $\frac{d^k x^n}{dx^k} = k! \binom{n}{k} x^{n-k}$ is the same as: If $f(x) = x^n$, then $f^{(k)}(x) = k! \binom{n}{k} x^{n-k}$