1. Compute $\sum_{j=5}^{200} 6$

$$\begin{aligned}\sum_{j=5}^{200} 6 &= 6 \cdot (200 - 5 + 1)\\ &= 6 \cdot (196)\end{aligned}$$

2. Compute $\sum_{p=-20}^{100} k$

$$\begin{aligned}\sum_{p=-20}^{100} k &= k \cdot (100 + 20 + 1)\\ &= k \cdot (121)\end{aligned}$$

3. Compute $\sum_{k=-5}^{100} 8^k$

$$\begin{aligned}\sum_{k=-5}^{100} 8^k &= \sum_{k=-5}^{-1} 8^k + \sum_{k=0}^{100} 8^k\\ &= \sum_{k=1}^{5} (\frac{1}{8})^k + \frac{8^{101} - 1}{8 - 1}\\ &= \frac{(\frac{1}{8})^k - 1}{(\frac{1}{8}) - 1} - 1 + \frac{8^{101} - 1}{8 - 1}\end{aligned}$$

4. Compute $\sum_{j=1}^{n} \sum_{i=1}^{j} (2 \cdot i + 3)$

$$\begin{aligned}\sum_{j=1}^{n} \sum_{i=1}^{j} (2 \cdot i + 3) &= \sum_{j=1}^{n} \sum_{i=1}^{j} 2 \cdot i + \sum_{j=1}^{n} \sum_{i=1}^{j} 3\\ &= \sum_{j=1}^{n} j^2 + \sum_{j=1}^{n} j + \sum_{j=1}^{n} 3 \cdot j\\ &= \frac{(n)(n+1)(2n+1)}{6} + \frac{n(n+1)}{2} + 3 \cdot \frac{n(n+1)}{2}\end{aligned}$$

5. Show $log_b(x^a) = alog_b(x)$

$$\begin{aligned}log_b x &= c\\ b^c &= x\\ b^{c \cdot a} &= x^a\\ c \dot{a} &= log_b(x^a)\\ c \cdot log_b(x) &= log_b(x^a)\end{aligned}$$

6. Show $log_b(x \cdot y) = log_b(x) + log_b(y)$

$$\begin{aligned}
log_b(x) &= p \\
log_b(y) &= s \\
x &= b^p \\
y &= b^s \\
x \cdot y &= b^{p \cdot s} \\
x \cdot y &= b^{p+s} \\
log_b(x \cdot y) &= p + s \\
log_b(x \cdot y) &= log_b(x) + log_b(y)
\end{aligned}$$

7. Show $log_b(\frac{x}{y}) = log_b(x) - log_b(y)$

$$\begin{aligned}
log_b(x) &= c \\
log_b(y) &= k \\
x &= b^c \\
y &= b^k \\
\frac{x}{y} &= \frac{b^c}{b^k} \\
\frac{x}{y} &= b^{c-k} \\
log_b(\frac{x}{y}) &= c - k \\
log_b(\frac{x}{y}) &= log_b(x) - log_b(y)
\end{aligned}$$

8. Show $b^{log_b x} = x$

$$\begin{aligned}
log_b x &= c \\
x &= b^c \\
x &= b^{log_b x}
\end{aligned}$$

9. Show $y^{log_b x} = x^{log_b y}$

$$\begin{aligned}
log_b(x) &= k \iff x = b^k \\
log_b(y) &= c \iff y = b^c \\
x^{log_b(y)} &= b^{k \cdot log_b(y)} \\
x^{log_b(y)} &= b^{log_b(y^k)} \\
x^{log_b(y)} &= y^k \\
x^{log_b(y)} &= y^{log_b(x)}
\end{aligned}$$

10. Show $log_b(x) = \frac{1}{log_x(b)}$

$$\begin{aligned}
log_b(x) &= c \\
log_x(b) &= k \\
x &= b^c \\
b &= x^k \\
x \cdot b &= b^c \cdot x^k \\
log_b(x) + 1 &= c + k \cdot log_b(x) \\
log_b(x) + 1 &= log_b(x) + log_x(b) \cdot log_b(x) \\
1 &= log_x(b) \cdot log_b(x) \\
\frac{1}{log_x(b)} &= log_b(x)
\end{aligned}$$

11. Show $log_b(x) = \frac{log_a(x)}{log_a(b)}$

$$\begin{aligned}
y &= log_b(x) \\
z &= log_a(x) \\
z &= log_a(b^y) \\
z &= y \cdot log_a(b) \\
z &= log_b(x) \cdot log_a(b) \\
log_a(x) &= log_b(x) \cdot log_a(b) \\
\frac{log_a(x)}{log_a(b)} &= log_a(x)
\end{aligned}$$

12. Compute $log_2(2^2 \times 3^4)$

$$\begin{aligned}
log_2(2^2) + log_2(3^4) &= 2 \cdot log_2(2) + 4 \cdot log_2(3) \\
&= 2 + +4 \cdot (1.5)
\end{aligned}$$

13. Compute $log_2(\frac{64 \times 128 \times 3}{1024 \times 2^{15}})$

$$\begin{aligned}
log_2(\frac{64 \times 128 \times 3}{1024 \times 2^{15}}) &= log_2(64 \times 128 \times 3) - log_2(1024 \times 2^{15}) \\
&= log_2(64) + log_2(128) + log_2(3) - log_2(1024) - 15 \cdot log_2(2) \\
&= 6 + 7 + (1.5) - 10 - 15
\end{aligned}$$

14. Compute $log_2(log_2(16))$

$$\begin{aligned} log_2(log_2(16)) &= log_2(4) \\ &= 2 \end{aligned}$$

15. Compute $(log_2(8))^4$

$$(log_2(8))^4 = (3)^4$$

16. Compute $(log_2^4 128^2)$

$$\begin{aligned} (log_2(128^2))^4 &= (2 \cdot log_2(128))^4 \\ &= 2^4 \cdot 7^4 \\ &= (2 \cdot 7)^4 \\ &= 14^4 \end{aligned}$$

17. Compute $5^{log_5(15)} + 3^{log_3(8)}$

$$5^{log_5(5)} + 3^{log_3(8)} = 5 + 8$$

18. Compute $8^{log_2(6)}$

$$\begin{aligned} 8^{log_2(6)} &= 2^{log_2(6^3)} \\ &= 6^3 \end{aligned}$$

19. Compute $4^{log_2(log_2(5))} + 6^{log_6(2)}$

$$2^{log_2(log_2(5)^2)} + 2 = log_2(5)^2 + 2$$

20. Compute $log_2((\frac{log_4(8)}{log_3(27)})^2)$

$$\begin{aligned} log_2((\frac{log_4(8)}{log_3(27})^2) &= log_2((\frac{\frac{3}{2}}{3})^2 \\ &= log_2((\frac{1}{2})^2) \\ &= log_2(\frac{1}{4}) \\ &= -2 \end{aligned}$$

21. Compute the deriative of $(2x^5 + 3x^9 + lnx)$

$$\frac{d}{dx}(2x^5 + 3x^9 + lnx) \quad = \quad 10x^4 + 27x^8 + \frac{1}{x}$$

22. Compute the deriative of $(ln^2(x) + x \cdot (x+1)^2)$

$$\frac{d}{dx}(ln^2(x) + x \cdot (x+1)^2) \quad = \quad 2 \cdot ln(x) \cdot \frac{1}{x} + (x+1)^2 + 2 \cdot x \cdot (x+1)$$

23. Compute the derivative of $\frac{\sqrt{5x+2}}{x \cdot sin(x)}$

$$\frac{d}{dx}(\frac{\sqrt{5 \cdot x + 2}}{x \cdot sin(x)}) \quad = \quad \frac{\frac{5}{2} \cdot (5 \cdot x + 2)^{-\frac{1}{2}}(x \cdot sin(x)) - (5 \cdot x + 2)^{\frac{1}{2}}(sin(x) + x \cdot cos(x)}{x^2 \cdot sin^2(x)}$$

24. Compute the derivative of $\sqrt{\frac{ln^2 x}{5 \cdot log_2 x^2 + 2}}$

$$\begin{aligned} \frac{d}{dx}(\sqrt{\frac{ln^2 x}{10 \cdot \frac{lnx}{ln(2)} + 2}} \quad) = & \quad \frac{1}{2} \cdot (\frac{ln^2(x)}{10 \cdot \frac{ln(x)}{ln(2)} + 2})^{-\frac{1}{2}} \\ \cdot & \quad \frac{(2 \cdot ln(x) \cdot \frac{1}{x}) \cdot (10 \cdot \frac{ln(x)}{ln(2)} + 2) - (ln^2(x) \cdot (10 \cdot \frac{ln(x)}{ln(2)} + 2)}{(10 \cdot \frac{ln(x)}{ln(2)} + 2)^2} \end{aligned}$$

25. Compute the deriative of $\sqrt{\sqrt{x}} \cdot (ln^2(x^2+5))$

$$\begin{aligned} \frac{d}{dx}(\sqrt{\sqrt{x}} \cdot (ln^2(x^2+5)) \quad = & \quad \frac{1}{4} x^{-\frac{3}{4}} \cdot (ln^2(x^2+5) \\ + & \quad x^{\frac{1}{4}} \cdot (2ln(x^2+5) \cdot \frac{1}{x^2+5} \cdot 2 \cdot x \end{aligned}$$