1. $\log_x \frac{1}{64} = 3$ $\quad \frac{\log \frac{1}{64}}{\log x}$

$x^3 = \frac{1}{64}$

$x = \left(\frac{1}{64}\right)^{\frac{1}{3}}$

$\boxed{x = \frac{1}{4}}$

2. $5^3 = 125$

$\boxed{\log_5 125 = 3}$

3. $f(x) = 12^x$

$= 12^{\left(\frac{2}{3}\right)}$

$= \sqrt[3]{12^2}$ $\quad 4 < 3 < 2$

$2 \cdot \boxed{2} \cdot 3$

$\boxed{2} \cdot 2 \cdot 3$

$\boxed{f\left(\frac{2}{3}\right) = 2\sqrt[3]{18}}$

4. $\log_5 17 = \frac{\log 17}{\log 5}$

$= 1.7603744$

$= 1.7604$

5. $16^{2x+1} = 8^{3x}$

$(2^4)^{2x+1} = (2^3)^{3x}$

$2^{8x+4} = 2^{9x}$

$8x+4 = 9x$

$\boxed{4 = x}$

6. NO

7. $\log_9 \frac{2\sqrt{5}}{7}$

$\log_9 2 + \log_9 (5)^{\frac{1}{2}} - \log_9 (7)$

$\log_9 2 + \frac{1}{2}\log_9 (5) - \log_9 (7)$

8. $\text{Log}_2 (0.1) = \frac{\log 0.1}{\log 2}$

$= \boxed{-3.3219}$

9. NO

10. $f(x) = \frac{2x+3}{x-4}$ $g(x) = \frac{4x+3}{x-2}$

$$f \circ g(x) = \frac{2\left(\frac{4x+3}{x-2}\right)+3}{\frac{4x+3}{x-2} - 4}$$

$$= \frac{\frac{8x+6}{x-2} + \frac{3x-6}{x-2}}{\frac{4x+3}{x-2} - \frac{4(x-2)}{x-2}}$$

$$= \frac{\frac{11x}{x-2}}{\frac{5}{x-2}}$$

$$= \frac{11x}{x-2} \div \frac{5}{x-2}$$

$$= \frac{11x}{\cancel{x-2}} \cdot \frac{\cancel{x-2}}{5}$$

$$= \frac{11x}{5}$$

No $f(x)$ and $g(x)$ are NOT inverses.

11. $\left(\frac{2}{3}\right)^{-3} = \frac{27}{8}$

$\log_{\frac{2}{3}}\left(\frac{27}{8}\right) = -3$

12. $\log_b P - \log_b q - \log_b r$

$\log_b\left(\frac{P}{qr}\right)$

13. $g(x) = \frac{2}{3}^{x}$

$g(1.5) = \frac{2}{3}^{1.5}$

$= 0.544$

14. $g(x) = \left(\frac{2}{3}\right)^{x}$

$g(3) = \left(\frac{2}{3}\right)^{3}$

$= \frac{8}{27}$

15. $4^{2x+1} = 8^{3x-6}$

$(2^2)^{2x+1} = (2^3)^{3x-6}$

$2(2x+1) = 3(3x-6)$

$4x+2 = 9x-18$

$20 = 5x$

$4 = x$

16. $5\log_a(z+7) + \log_a(2z+9)$

$\log_a(z+7)^5 + \log_a(2z+9)$

$\log_a(z+7)^5(2z+9)$

17. $f(x) = 2x + 4 \qquad g(x) = \frac{1}{2}x - 2$

$(f \circ g)(x) = 2\left(\frac{1}{2}x - 2\right) + 4$

$= x - 4 + 4$

$= x$

$(g \circ f)(x) = \frac{1}{2}(2x + 4) - 2$

$= x + 2 - 2$

$= x$

yes $f(x)$ & $g(x)$ are inverses.

18. $\log(8) = 0.9031$

20. $\log_6(4x - 7y)$

This is not possible