Chapter 25: Logarithms

1. $\boxed{D}$ By the definition of a log, $\log_4 x = 3$ is equivalent to $4^3 = x$. Therefore, $x = 64$.

2. $\boxed{D}$ By the definition of a log, $5^a = 3$ and $5^b = 4$. Multiplying both equations, we get

$$5^a \cdot 5^b = 3 \cdot 4$$
$$5^{a+b} = 12$$

3. $\boxed{E}$ By the definition of a log, $c^{\frac{1}{2}} = 9$. Squaring both sides, $c = 81$.

4. $\boxed{C}$ By the definition of a log, $5^x = 4$. Now,

$$5^{2-x} = 5^2 \cdot 5^{-x} = \frac{5^2}{5^x} = \frac{25}{4}$$

5. $\boxed{A}$

$$\begin{aligned} \log_3 x^2 &= c \\ 2\log_3 x &= c \\ \log_3 x &= \frac{c}{2} \end{aligned}$$

6. $\boxed{B}$ $\log_2 63 = \log_2(7 \cdot 3^2) = \log_2 7 + \log_2 3^2 = \log_2 7 + 2\log_2 3 = p + 2q$

7. $\boxed{C}$ $\log\left((3x)^2\right) = 2\log(3x) = 2(\log 3 + \log x) = 2\log 3 + 2\log x$.

8. $\boxed{D}$ By the definition of a log, $x = \log_a b$ and $y = \log_a c$. Therefore, $xy = (\log_a b)(\log_a c)$.

9. $\boxed{A}$

$$\begin{aligned} \log_4(x+3) + \log_4(x-3) &= 2 \\ \log_4\left((x+3)(x-3)\right) &= 2 \\ (x+3)(x-3) &= 4^2 \\ x^2 - 9 &= 16 \\ x^2 &= 25 \\ x &= 5 \end{aligned}$$

10. $\boxed{A}$

$$\begin{aligned} \log_b 40 - \log_b 5 &= 3 \\ \log_b 8 &= 3 \\ b^3 &= 8 \\ b &= \sqrt[3]{8} = 2 \end{aligned}$$