Logarithms: Definition, Graphs and Solving for n

MEMORANDUM

Name: ..... Class: .....

Date: .....

MARK ____ / 23

Answer all questions. Show all your working — marks are awarded for method as well as the final answer. **Teacher copy: accept any correct equivalent method.**

1 Evaluate $\log_2 16$. *(evaluate)* (1)

$2^4 = 16 \rightarrow \mathbf{4}$ ✓ (1)

2 Evaluate $\log_3 27$. *(evaluate)* (1)

$3^3 = 27 \rightarrow \mathbf{3}$ ✓ (1)

3 Evaluate $\log_{10} 1\,000$. *(evaluate)* (1)

$10^3 = 1000 \rightarrow \mathbf{3}$ ✓ (1)

4 Write $5^3 = 125$ in log form. *(convert)* (1)

$\mathbf{\log_5 125 = 3}$ ✓ (1)

5 Write $\log_2 32 = 5$ in exponent form. *(convert)* (1)

$\mathbf{2^5 = 32}$ ✓ (1)

6 Solve $\log_2 x = 5$. *(definition)* (2)

$x = 2^5$ *(1)*
$x = \mathbf{32}$ *(1)* ✓✓ (2)

7 Write down the inverse of $f(x) = 3^x$ in the form $y = \ldots$ *(inverse)* (2)

swap x and y: $x = 3^y$ *(1)*
$\mathbf{y = \log_3 x}$ *(1)* ✓✓ (2)

8 State the domain and the range of $y = \log_2 x$. *(graph)* (2)

domain: $\mathbf{x > 0}$ *(1)*
range: $\mathbf{y \in \mathbb{R}}$ *(1)* ✓✓ (2)

9 Money invested at 8% p.a. compound interest doubles after n years. Find n (2 dp). *(finance)* **(2)**

> $2 = (1{,}08)^n$ *(1)*
> $n = \log_{1{,}08} 2 \approx$ **9,01 years** *(1)* ✓✓ (2)

10 Solve $2^x = 20$ (2 dp). *(solve)* **(3)**

> $x = \log_2 20$ *(2)*
> $x \approx$ **4,32** *(1)* ✓✓✓ (3)

11 A machine bought for R$80\,000$ depreciates at 15% p.a. on the reducing balance. After how many full years will it first be worth less than R$30\,000$? **(4)**

> $30\,000 = 80\,000(0{,}85)^n$ *(1)*
> $0{,}85^n = 0{,}375$ so $n = \log_{0{,}85} 0{,}375 = 6{,}04\ldots$ *(2)*
> **After 7 years** *(1)* ✓✓✓✓ (4)

12 Given $g(x) = 3^x$, write down $g^{-1}(x)$ and solve $g^{-1}(x) > 2$. **(3)**

> $g^{-1}(x) = \log_3 x$ *(1)*
> $\log_3 x > 2 \rightarrow \boldsymbol{x > 9}$ *(2)* ✓✓✓ (3)

TOTAL: 23 marks

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