AL AMAL LEARNING CENTER

FBISE SSC-I Model Paper Pattern

ANSWER KEY

Mathematics Chapter Quiz | Class 9 | Unit 2

LOGARITHMS

SECTION A – MCQs (32 × 0.5 = 16 Marks)

Q#	Ans	Working
1.	**C**	0.00053407: move the decimal 4 places to the right, so it is 5.3407×10^{-4}. **Answer: C) 5.3407×10^{-4}**
2.	**D**	10^{-6} moves the decimal 6 places to the left: 0.00000653. **Answer: D) 0.00000653**
3.	**A**	$b^y = x \Leftrightarrow y = \log_b x$. So $2^7 = 128$ gives $\log_2 128 = 7$. **Answer: A) $\log_2 128 = 7$**
4.	**B**	$4^3 = 64$, so $\log_4 64 = 3$. **Answer: B) 3**
5.	**C**	No power of 2 gives 0, so $\log_2 0$ is undefined. **Answer: C) $\log_2 0$**
6.	**B**	$\log_b 1 = 0$ and $\log_b b = 1$, so the sum is 0 + 1 = 1. **Answer: B) 1**
7.	**A**	$x^2 = 9$, so $x = \pm 3$. A base must be positive, so $x = 3$. **Answer: A) 3**
8.	**D**	$0.0093 = 9.3 \times 10^{-3}$, so the characteristic is −3. **Answer: D) −3**
9.	**B**	$156.3 = 1.563 \times 10^2$, so the characteristic is 2. log 156.3 = 2 + 0.1939 = 2.1939. **Answer: B) 2.1939**
10.	**C**	$\log x = -3$ means $x = 10^{-3} = 0.001$. **Answer: C) 0.001**
11.	**A**	$\ln e^5 = 5 \ln e = 5(1) = 5$. **Answer: A) 5**
12.	**D**	$\log 36 = \log 6^2 = 2 \log 6$. **Answer: D) 2 log 6**
13.	**C**	$\log a - \log b = \log (a/b)$, so $\log 5 - \log 2 = \log (5/2)$. **Answer: C) log (5/2)**
14.	**A**	$\log_a b \times \log_b a = (\log b / \log a) \times (\log a / \log b) = 1$. **Answer: A) 1**
15.	**B**	Change of base: $\log_a m = \log m / \log a$, so $\log_3 5 = \log 5 / \log 3$. **Answer: B) log 5 / log 3**
16.	**D**	$3 \log 2 = \log 2^3 = \log 8$. Then $\log 8 + \log 5 = \log (8 \times 5) = \log 40$. **Answer: D) log 40**
17.	**A**	$\log (xy^2/z) = \log x + \log y^2 - \log z = \log x + 2 \log y - \log z$. **Answer: A) log x + 2 log y − log z**
18.	**C**	$2 \log x - 3 \log y = \log x^2 - \log y^3 = \log (x^2/y^3)$. **Answer: C) log ($x^2$ / y^3)**
19.	**D**	Number of digits = characteristic + 1 = 5 + 1 = 6. **Answer: D) 6**
20.	**B**	$100^{100} = (10^2)^{100} = 10^{200}$. log = 200, so the number of digits = 200 + 1 = 201. **Answer: B) 201**
21.	**C**	$M = \log (I/I_0)$ gives $I = I_0 \times 10^M$. For M = 7, $I = 10^7 I_0$. **Answer: C) $10^7 I_0$**
22.	**A**	$I_A/I_B = 10^{7-5} = 10^2 = 100$. **Answer: A) 100**
23.	**D**	$M = \log (1000 I_0 / I_0) = \log 1000 = \log 10^3 = 3$. **Answer: D) 3**
24.	**B**	A rise of 1 in M gives $I \times 10^1$, so the intensity is multiplied by 10. **Answer: B) 10**
25.	**B**	$\log 6 = \log 2 + \log 3 = 0.3010 + 0.4771 = 0.7781$. **Answer: B) 0.7781**
26.	**D**	$\log (3/2) = \log 3 - \log 2 = 0.4771 - 0.3010 = 0.1761$. **Answer: D) 0.1761**
27.	**A**	$\log 8 = \log 2^3 = 3(0.3010) = 0.9030$. **Answer: A) 0.9030**

Q#	Ans	Working
28.	**C**	$\log 5^{10} = 10 \times 0.6990 = 6.990$. Characteristic = 6, so digits = 6 + 1 = 7. **Answer: C) 7**
29.	**C**	$\log_2 x = 6$ means $x = 2^6 = 64$. **Answer: C) 64**
30.	**B**	$\log_3 (x + 1) = 2$ gives $x + 1 = 3^2 = 9$, so $x = 8$. **Answer: B) 8**
31.	**D**	$\log x = \log 12 - \log 4 = \log (12/4) = \log 3$, so $x = 3$. **Answer: D) 3**
32.	**A**	$\log_x 81 = 4$ gives $x^4 = 81$, so $x = 3$. A base must be positive, so -3 is rejected. **Answer: A) 3**

SECTION B – Short Questions (6 × 3 = 18 Marks)

Q#	Part	Solution	Marks
Q1	**(a)**	$(3.2 \times 1.5 \div 4) \times 10^{5-2+1} =$ **1.2×10^4**	**3**
	(b)	(i) $9.067 \times 10^{-5} =$ **0.00009067** (ii) $3.1415 \times 10^9 =$ **3,141,500,000**	**3**
Q2	**(a)**	(i) $x = 5^3 =$ **125** (ii) $(x + 1)^2 = 16$, so $x + 1 = 4$ and **$x = 3$** (iii) $x^2 - 1 = 2^3 = 8$, so $x^2 = 9$ and **$x = \pm 3$**	**3**
	(b)	(i) $\log [(x + 3)(x - 3)] = \log 16$, so $x^2 - 9 = 16$ and $x^2 = 25$. Thus $x = \pm 5$, but $x = -5$ is rejected (log of a negative number is undefined). **$x = 5$** (ii) $x = 4^{-2} =$ **1/16** (iii) $\log_2 64 = 6$, so $6 = x + 1$ and **$x = 5$**	**3**
Q3	**(a)**	$\log a^2 + \log \sqrt{b} - \log c^3 =$ **$2 \log a + \frac{1}{2} \log b - 3 \log c$**	**3**
	(b)	**$\frac{1}{5} [2 \log 7 + 3 \log t + \log p - 6 \log d - 2 \log b]$**	**3**
Q4	**(a)**	$\log t^{1/2} + \log r^{1/3} - \log s^{1/5} =$ **$\log (\sqrt{t} \cdot \sqrt[3]{r} / \sqrt[5]{s})$**	**3**
	(b)	**$\log [(57.7 \times (36.6)^4) / ((9.24)^3 \times (23.3)^2)]^{1/7}$**	**3**
Q5	**(a)**	(i) $\log 30 = \log 3 + \log 10 = 0.4771 + 1 =$ **1.4771** (ii) $\log 0.45 = \log 45 - 2 = 2(0.4771) + 0.6990 - 2 = 1.6532 - 2 =$ **$\bar{1}.6532$** (that is, $-1 + 0.6532 = -0.3468$)	**3**
	(b)	(i) $\log 6 - \log 5 = 0.7781 - 0.6990 =$ **0.0791** (ii) $\log 100 - \log 9 = 2 - 2(0.4771) =$ **1.0458** (iii) $\log 360 = 3(0.3010) + 2(0.4771) + 0.6990 =$ **2.5562**	**3**
Q6	**(a)**	$\log 3^{40} = 40 \times 0.4771 = 19.084$. Characteristic = 19, so the number of digits = 19 + 1 = **20**	**3**
	(b)	$529^{30} = (23^2)^{30} = 23^{60}$. log = $60 \times 1.3617 = 81.702$. Characteristic = 81, so the number of digits = **82**	**3**

SECTION C – Long Questions (5 × 6 = 30 Marks)

Q#	Part	Solution	Marks
Q7	(a)	Let $N = (\sqrt[3]{74.3} \times (5.46)^2) / (2.83 \times \sqrt{3.97})$. $\log N = \frac{1}{3}\log 74.3 + 2\log 5.46 - \log 2.83 - \frac{1}{2}\log 3.97$ $= \frac{1}{3}(1.8710) + 2(0.7372) - 0.4518 - \frac{1}{2}(0.5988)$ $= 0.6237 + 1.4744 - 0.4518 - 0.2994 = 1.3469$ $N = \text{antilog } 1.3469 \approx$ **22.23**	**6**
	(b)	(i) $\log N = 2\log 27.98 - 3\log 28.73 = 2(1.4468) - 3(1.4583) = 2.8936 - 4.3749 = -1.4813 = 2.5187$ (that is, $-2 + 0.5187$). $N \approx$ **0.0330** [3] (ii) $\log N = \frac{1}{2}\log 16.75 - \frac{1}{3}\log 53 = \frac{1}{2}(1.2240) - \frac{1}{3}(1.7243) = 0.6120 - 0.5748 = 0.0372$. $N \approx$ **1.09** [3]	**3+3**
Q8	(a)	(i) $M_1 = \log I_1 - \log I_0$ and $M_2 = \log I_2 - \log I_0$. Subtracting: $M_1 - M_2 = \log I_1 - \log I_2 = \log (I_1/I_2)$. [2] (ii) $\log (I_1/I_2) = 8.1 - 6.9 = 1.2$, so $I_1/I_2 = 10^{1.2} \approx$ **15.85 times** [2] (iii) $5 = \log (I/I_0)$, so $I/I_0 = 10^5$ and $\mathbf{I = 10^5\ I_0}$ [2]	**2+2+2**
	(b)	(i) $\log (I_1/I_2) = 8.5 - 7.8 = 0.7$, so $I_1/I_2 = 10^{0.7} \approx$ **5.01 times** [2] (ii) $6.5 = \log (I/I_0)$, so $\mathbf{I = 10^{6.5}\ I_0 \approx 3.16 \times 10^6\ I_0}$ [2] (iii) Same proof as part (a)(i). [2]	**2+2+2**
Q9	(a)	(i) Let $\log_b m = x$ and $\log_b n = y$, so $m = b^x$ and $n = b^y$. Then $m/n = b^{x-y}$, which gives $\log_b (m/n) = x - y = \log_b m - \log_b n$. [3] (ii) $\log (75/16) - \log (5/9)^2 + \log (32/243) = \log [(75/16) \times (81/25) \times (32/243)] = \log [(75 \times 81 \times 32) / (16 \times 25 \times 243)] =$ **log 2** [3]	**3+3**
	(b)	(i) Let $\log_b m = x$ and $\log_b n = y$, so $m = b^x$ and $n = b^y$. Then $mn = b^{x+y}$, which gives $\log_b (mn) = x + y = \log_b m + \log_b n$. [3] (ii) LHS $= \log [(a^2/bc) \times (b^2/ca) \times (c^2/ab)] = \log [a^2b^2c^2 / a^2b^2c^2] = \log 1 = 0 =$ RHS. [3]	**3+3**
Q10	(a)	(i) $2P = P(1.06)^t$, so $2 = (1.06)^t$. Taking log of both sides: $\log 2 = t \log 1.06$ $t = \log 2 / \log 1.06 = 0.3010 / 0.0253 \approx$ **11.9 years** [3] (ii) $3 = (1.06)^t$, so $t = \log 3 / \log 1.06 = 0.4771 / 0.0253 \approx$ **18.9 years** [3]	**3+3**
	(b)	(i) $N = 200 \times 2^{12/3} = 200 \times 2^4 = 200 \times 16 =$ **3200 bacteria** [2] (ii) $10{,}000 = 200 \times 2^{t/3}$, so $2^{t/3} = 50$. Taking log: $(t/3)\log 2 = \log 50$ $\log 50 = \log 100 - \log 2 = 2 - 0.3010 = 1.6990$ $t/3 = 1.6990 / 0.3010 = 5.644$, so $t = 3 \times 5.644 \approx$ **16.93 hours** [4]	**2+4**
Q11	(a)	(i) $pH = -\log (4 \times 10^{-7}) = -(\log 4 + \log 10^{-7}) = -(0.6021 - 7) = 7 - 0.6021$ $=$ **6.3979 ≈ 6.40** [3] (ii) $[H^+] = 10^{-pH}$. For pH 3 it is 10^{-3} and for pH 5 it is 10^{-5}. Ratio $= 10^{-3} / 10^{-5} = 10^2 =$ **100 times** [3]	**3+3**
	(b)	(i) $0.3\ N_0 = N_0\ (0.5)^{t/5730}$, so $0.3 = (0.5)^{t/5730}$ [2] (ii) Taking log: $\log 0.3 = (t/5730)\log 0.5$ $\log 0.3 = \log 3 - \log 10 = 0.4771 - 1 = -0.5229$ and $\log 0.5 = -\log 2 = -0.3010$ $t = 5730 \times (-0.5229) / (-0.3010) = 5730 \times 1.7372 \approx$ **9,954 years** [4]	**2+4**