CLASS 9 · CHAPTER 2 · REVIEW EXERCISE 2

Logarithms Review - Super Easy

Very short lines. Very small steps.

This is the whole chapter, one more time, slowly.

You have done all of this before. You can do this.



How to read this book

*Read **one box**.*
Stop.
*Look at the **example**.*
*Say the steps **out loud**.*
Then read the next box.

In this book you will learn

- *Question 1 - MCQs, with the reason for each answer*
- *Questions 2 to 5 - scientific notation, log form, power form*
- *Questions 6 to 8 - find x, one log, expand*
- *Questions 9 and 10 - log table and population*

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First: Your Toolbox

Every question in this review uses these same small rules.

Scientific notation

Write the number as $a \times 10^n$, where a is from 1 to 9.99...
Point moves **right** for small numbers: power is **minus**.
Point moves **left** for big numbers: power is **plus**.

Log form and power form are the same thing

$$\log_b N = p \leftrightarrow b^p = N$$

Say it: "**The base jumps up.**"

The laws of logarithms

Times is **plus**: $\log (a \times b) = \log a + \log b$
Divide is **minus**: $\log (a / b) = \log a - \log b$
Power comes **in front**: $\log a^n = n \times \log a$
$\log_a a = 1$ and $\log_a 1 = 0$

And remember: log = **Characteristic** + **Mantissa**. The **Characteristic** is the whole-number part. The **Mantissa** is the decimal part.

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Question 1 – MCQs, part 1

Four options are given. Pick the correct one. The reason is under each question.

(i). The standard form of 5.2×10^6 is:

(a) 52,000 (b) 520,000 (c) 5,200,000 (d) 52,000,000

1 $10^6 = 1{,}000{,}000$. $5.2 \times 1{,}000{,}000 = 5{,}200{,}000$.

Answer: (c) 5,200,000

(ii). Scientific notation of 0.00034 is:

(a) 3.4×10^3 (b) 3.4×10^{-4} (c) 3.4×10^4 (d) 3.4×10^{-3}

1 Move the point **4 places right** to get 3.4. Point moved right, so the power is minus.

Answer: (b) 3.4×10^{-4}

(iii). The base of common logarithm is:

(a) 2 (b) 10 (c) 5 (d) e

1 Common log always means base **10**. When no base is written, it is 10.

Answer: (b) 10

(iv). $\log_2 2^3 =$

(a) 1 (b) 2 (c) 5 (d) 3

1 Power comes in front: $3 \times \log_2 2 = 3 \times 1$.

Answer: (d) 3

(v). $\log 100 =$

(a) 2 (b) 3 (c) 10 (d) 1

1 $100 = 10^2$. So $\log 10^2 = 2 \times \log 10 = 2 \times 1$.

Answer: (a) 2

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Question 1 – MCQs, part 2

(vi). If log 2 = 0.3010, then log 200 is:

(a) 1.3010 (b) 0.6010 (c) 2.3010 (d) 2.6010

1 200 = 2 × 100. So log 200 = log 2 + log 100 = 0.3010 + 2 = 2.3010.

Answer: (c) 2.3010

(vii). log (0) =

(a) Positive (b) Negative (c) Zero (d) Undefined

Answer: (d) Undefined — no power of 10 can make 0

(viii). log 10,000 =

(a) 2 (b) 3 (c) 4 (d) 5

1 10,000 = 10^4. Count the zeros: 4 zeros, power 4.

Answer: (c) 4

(ix). log 5 + log 3 =

(a) log 0 (b) log 2 (c) log (5/3) (d) log 15

1 Plus joins into one log, and the numbers **times**: log (5 × 3).

Answer: (d) log 15

(x). $3^4 = 81$ in logarithmic form is:

(a) $\log_3 4 = 81$ (b) $\log_4 3 = 81$ (c) $\log_3 81 = 4$ (d) $\log_4 81 = 3$

1 Base stays the base: 3. The power becomes the answer: 4.

Answer: (c) $\log_3 81 = 4$

All 10 answers: (i) C (ii) B (iii) B (iv) D (v) A (vi) C (vii) D (viii) C (ix) D (x) C

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Question 2 - Scientific Notation

The one job

*Move the point so only **one digit** is in front of it.*
Count how far you moved. That count is the power of 10.

(i). 0.000567

1. Move the point **4 places right**: 0.000567 becomes 5.67.
2. Point moved right, so the power is **minus** 4.

Answer: 5.67×10^{-4}

(ii). 734

1. 734 is big. Move the point **2 places left**: 734 becomes 7.34.
2. Point moved left, so the power is **plus** 2.

Answer: 7.34×10^{2}

(iii). 0.33×10^{3}

1. Careful: 0.33 is too small. It must be between 1 and 10.
2. $0.33 = 3.3 \times 10^{-1}$. Move the point 1 place right, power drops by 1.
3. Now: $3.3 \times 10^{-1} \times 10^{3} = 3.3 \times 10^{3-1}$.

Answer: 3.3×10^{2}

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Question 3 - Ordinary Notation

Question 2 in **reverse**: the power tells how far to move the point.

(i). 2.6×10^3

1. Power is +3. Move the point **3 places right**: 2.6 becomes 2600.

Answer: 2600

(ii). 8.794×10^{-4}

1. Power is −4. Move the point **4 places left**. Fill the gaps with zeros.

Answer: 0.0008794

(iii). 6×10^{-6}

Answer: 0.000006 — move the point 6 places left from 6

Question 4 - Logarithmic Form

The swap rule: in $b^p = N$, the **base** stays the base of the log, and the **power** becomes the answer of the log.

(i). $3^7 = 2187$

Answer: $\log_3 2187 = 7$

(ii). $a^b = c$

Answer: $\log_a c = b$

(iii). $12^2 = 144$

Answer: $\log_{12} 144 = 2$

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Question 5 - Exponential Form

*Now the swap goes the **other way**. Log form becomes power form.*
*Say it: "**The base jumps up.**"*

(i). $\log_4 8 = x$

1. Base 4 jumps up. The answer of the log, x, becomes the power.

Answer: $4^x = 8$

(ii). $\log_9 729 = 3$

1. Base 9 jumps up. The answer 3 becomes the power.

Answer: $9^3 = 729$

(iii). $\log_4 1024 = 5$

1. Base 4 jumps up. The answer 5 becomes the power.

Answer: $4^5 = 1024$

Question 6 - Find x

(i). $\log_9 x = 0.5$

1. Base 9 jumps up: $x = 9^{0.5}$.
2. Power 0.5 means **root**. $9^{0.5} = \sqrt{9}$.
3. $\sqrt{9} = 3$, because $3 \times 3 = 9$.

Answer: $x = 3$

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Question 6 - more sums

The key idea for both sums

Make **both sides the same base.**
Then the **powers must be equal.**

(ii). $(1/9)^{3x} = 27$

1. Write everything as powers of 3. $9 = 3^2$, so $1/9 = 3^{-2}$. $27 = 3^3$.
2. $(3^{-2})^{3x} = 3^3$. Powers times together: $-2 \times 3x = -6x$.
3. Now: $3^{-6x} = 3^3$. Bases are the same, so powers are equal: $-6x = 3$.
4. $x = 3 / (-6)$. Cut it down: $3/6 = 1/2$.

Answer: $x = -1/2$

(iii). $(1/32)^{2x} = 64$

1. Write everything as powers of 2. $32 = 2^5$, so $1/32 = 2^{-5}$. $64 = 2^6$.
2. $(2^{-5})^{2x} = 2^6$. Powers times together: $-5 \times 2x = -10x$.
3. Now: $2^{-10x} = 2^6$. Bases are the same, so powers are equal: $-10x = 6$.
4. $x = 6 / (-10)$. Cut it down: $6/10 = 3/5$.

Answer: $x = -3/5$

Careful: the minus sign stays with x. Both answers here are **negative.**

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Question 7 – Make ONE Log

*First push every number in front **up** as a power. Then join.*
Plus = top. Minus = bottom.

(i). $7 \log x - 3 \log y^2$

1. 7 goes up: $\log x^7$. 3 goes up: $\log (y^2)^3 = \log y^6$.
2. Now: $\log x^7 - \log y^6$. Minus means **divide**.

Answer: $\log (x^7 / y^6)$

(ii). $3 \log 4 - \log 32$

1. 3 goes up: $\log 4^3 - \log 32$. $4^3 = 64$.
2. $\log 64 - \log 32$. Minus means divide: $\log (64 / 32)$.
3. $64 / 32 = 2$.

Answer: $\log 2$

(iii). $\frac{1}{3} (\log_5 8 + \log_5 27) - \log_5 3$

1. $8 = 2^3$ and $27 = 3^3$. Powers come in front, then the $\frac{1}{3}$ cuts the 3.
2. $\frac{1}{3} \log_5 8 = \log_5 2$. And $\frac{1}{3} \log_5 27 = \log_5 3$.
3. Now: $\log_5 2 + \log_5 3 - \log_5 3$. The $\log_5 3$ parts **cut each other**.

Answer: $\log_5 2$

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Question 8 - Open the Log Out (Expand)

*This is Question 7 in **reverse**. One log becomes many small logs.*

(i). $\log(xyz^6)$

1. Everything is **times** inside. Times splits into plus.
2. $\log x + \log y + \log z^6$. Then the power 6 comes in front.

Answer: $\log x + \log y + 6 \log z$

(ii). $\log_3 \sqrt[6]{(m^5 n^3)}$ (6th root)

1. 6th root means power 1/6. Bring it in front: $1/6 \log_3 (m^5 n^3)$.
2. Times inside splits into plus: $1/6 (\log_3 m^5 + \log_3 n^3)$.
3. Powers come in front: $1/6 (5 \log_3 m + 3 \log_3 n)$.
4. Open the bracket: $5/6 \log_3 m + 3/6 \log_3 n$. And $3/6 = 1/2$.

Answer: $5/6 \log_3 m + 1/2 \log_3 n$

(iii). $\log \sqrt{(8x^3)}$

1. Look inside first: $8x^3 = 2^3 x^3 = (2x)^3$.
2. Root means power 1/2. So $(2x)^3$ with power 1/2 gives $(2x)^{3/2}$.
3. Power comes in front: $3/2 \log(2x)$. Then split the times inside.

Answer: $3/2 (\log 2 + \log x)$

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Question 9 - Use the Log Table

Same 4 steps, every time

1. Call the answer **x**.
2. Take **log** of both sides. Use the laws.
3. Put the table values in. Add and subtract.
4. Take **Antilog**. That gives x.

(i). $\sqrt[3]{68.24}$ (cube root)

1. Let x = $\sqrt[3]{68.24}$. Cube root = power ⅓. Take log of both sides.
2. log x = ⅓ log 68.24.
3. From the table: log 68.24 = **Characteristic 1** + **Mantissa 0.8340** = 1.8340.
4. log x = ⅓ × 1.8340 = **0.6113**. Antilog of 0.6113: **Characteristic = 0**, **Mantissa = 0.6113**.

Answer: x = 4.086

(ii). 319.8 × 3.543

1. Let x = 319.8 × 3.543. Take log of both sides. Times becomes plus.
2. log x = log 319.8 + log 3.543.
3. log 319.8: **Characteristic = 2**, **Mantissa = 0.5049**, so 2.5049.
log 3.543: **Characteristic = 0**, **Mantissa = 0.5494**, so 0.5494.
4. log x = 2.5049 + 0.5494 = **3.0543**. Take Antilog.

Answer: x = 1133.182

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Question 9 - one more sum

(iii). (36.12 × 750.9) / (113.2 × 9.98)

1. Let x = that whole fraction. Take log of both sides.
2. Top numbers get **plus**. Bottom numbers get **minus**.
3. log x = log 36.12 + log 750.9 − log 113.2 − log 9.98.
4. Table values, one by one:

log 36.12: **Characteristic = 1**, **Mantissa = 0.5577** → 1.5577
log 750.9: **Characteristic = 2**, **Mantissa = 0.8756** → 2.8756
log 113.2: **Characteristic = 2**, **Mantissa = 0.0538** → 2.0538
log 9.98: **Characteristic = 0**, **Mantissa = 0.9991** → 0.9991

5. log x = 1.5577 + 2.8756 − 2.0538 − 0.9991 = **1.3804**.
6. Take Antilog of 1.3804: **Characteristic = 1**, **Mantissa = 0.3804**.

Answer: x = 24.01

Remember: Antilog is the way back. Log takes a number in. Antilog brings the number out.

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Question 10 - Population of a City

In the year **2016**, the population of a city was **22 million**.
It grows by **2.5%** every year. The rule is:

$$p(t) = 22\,(1.025)^t$$

p(t) = population in millions. **t** = years after 2016.
Find the year when the population reaches **35 million**.

1. Put $p(t) = 35$ into the rule: $35 = 22\,(1.025)^t$.
2. Take log of both sides: $\log 35 = \log 22 + t \times \log 1.025$.
3. Table values: $\log 35 = 1.5441$, $\log 22 = 1.3424$, $\log 1.025 = 0.0107$.
4. $1.5441 = 1.3424 + t\,(0.0107)$. Move the 1.3424: $1.5441 - 1.3424 = 0.2017$.
5. $t = 0.2017 / 0.0107 = 18.85$. Round it: about **19 years**.
6. Start year + 19 years: $2016 + 19 = 2035$.

Answer: The population reaches 35 million in the year 2035

Well done. You finished the whole chapter review. Next page: every answer, for checking.

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Remember - Check Your Answers

Question	Answers
Q1 MCQs	(i) C (ii) B (iii) B (iv) D (v) A (vi) C (vii) D (viii) C (ix) D (x) C
Q2 Scientific notation	(i) 5.67×10^{-4} (ii) 7.34×10^{2} (iii) 3.3×10^{2}
Q3 Ordinary notation	(i) 2600 (ii) 0.0008794 (iii) 0.000006
Q4 Log form	(i) $\log_3 2187 = 7$ (ii) $\log_a c = b$ (iii) $\log_{12} 144 = 2$
Q5 Power form	(i) $4^x = 8$ (ii) $9^3 = 729$ (iii) $4^5 = 1024$
Q6 Find x	(i) 3 (ii) −1/2 (iii) −3/5
Q7 One log	(i) $\log (x^7 / y^6)$ (ii) log 2 (iii) $\log_5 2$
Q8 Expand	(i) log x + log y + 6 log z (ii) 5/6 $\log_3$ m + 1/2 $\log_3$ n (iii) 3/2 (log 2 + log x)
Q9 Log table	(i) 4.086 (ii) 1133.182 (iii) 24.01
Q10 Population	t = 18.85, about 19 years Year = 2035

✓ Point right = minus power. Point left = plus power.

✓ The base jumps up: $\log_b N = p$ means $b^p = N$.

✓ Times is plus. Divide is minus. Power comes in front.

✓ Log table: log first, then Antilog. **Characteristic** + **Mantissa**.

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