# Logs and Infinite Geometric Series: exam practice

10 questions · 30 marks · worked solutions and markschemes

Name _____ Date _____ Score / 30

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlai/logs-and-infinite-geometric-series-exam-practice

**1.** **2 marks · Paper 1 style · calculator allowed**

Evaluate $27^{\frac{2}{3}}$.

**2.** **3 marks · Paper 1 style · calculator allowed**

Write $\sqrt[3]{x^2} \times x^{\frac{1}{2}}$ as a single power of $x$, and evaluate $64^{\frac{2}{3}}$.

Simplify and evaluate. **[3]**

**3.** **2 marks · Paper 1 style · calculator allowed**

Solve $8^x = \dfrac{1}{32}$.

**4.** **2 marks · Paper 1 style · calculator allowed**

An infinite geometric series has first term $45$ and common ratio $-\frac{2}{3}$.

Find the sum to infinity. **[2]**

**5.** **2 marks · Paper 1 style · calculator allowed**

Solve $\log_3(2x-1)=4$.

Find $x$. **[2]**

**6.** **2 marks · Paper 1 style · calculator allowed**

Find the value of $\sum_{k=1}^{\infty} 6(0.25)^k$.

Find the sum. **[2]**

**7.** **3 marks · Paper 1 style · calculator allowed**

Solve $x^{\frac{3}{2}}=27$ and $8^y=\frac{1}{4}$.

Find $x$ and $y$. **[3]**

**8.** **4 marks · Paper 1 style · calculator allowed**

The sum to infinity of a geometric series is $12$ and its first term is $4$.

Find the common ratio and the sum of the first $5$ terms. **[4]**

**9.** **4 marks · Paper 2 style · calculator allowed**

A pendulum swings $40$ cm on its first swing. Each swing is $92\%$ of the one before.

**(a)** Find the total distance travelled in the first $20$ swings. **[2]**

**(b)** Find the total distance travelled before it stops. **[2]**

**10.** **6 marks · Paper 1 style · calculator allowed**

An infinite geometric series has first term $u_1 = 6$ and common ratio $r = \frac{1}{4}$.

a. Find the sum to infinity, $S_\infty$.

b. Given that $\log_k(S_\infty + 8) = 2$, find the value of $k$.

## Answers and worked solutions

### Question 1

2 marks

**Answer:** $9$

$\left(\sqrt[3]{27}\right)^2$ (M1)

$= 9$ A1

### Question 2

3 marks

**Answer:** $x^{\frac{7}{6}}$; $16$

$x^{\frac{2}{3}+\frac{1}{2}}$ M1

$x^{\frac{7}{6}}$ A1

$16$ A1

### Question 3

2 marks

**Answer:** $-5/3$

$2^{3x} = 2^{-5}$ M1

$x = -\dfrac{5}{3}$ A1

### Question 4

2 marks

**Answer:** $27$

$\dfrac{45}{1+\frac{2}{3}}$ M1

$27$ A1

### Question 5

2 marks

**Answer:** $41$

$2x - 1 = 81$ M1

$x = 41$ A1

### Question 6

2 marks

**Answer:** $2$

$u_1 = 1.5,\ r = 0.25$ A1

$\dfrac{1.5}{0.75} = 2$ A1

### Question 7

3 marks

**Answer:** $x = 9, y = -\dfrac{2}{3}$

$x = 27^{\frac{2}{3}} = 9$ A1

$2^{3y} = 2^{-2}$ M1

$y = -\dfrac{2}{3}$ A1

### Question 8

4 marks

**Answer:** $r = \dfrac{2}{3}$; $\dfrac{844}{81} \approx 10.4$

$\dfrac{4}{1-r} = 12$ M1

$r = \dfrac{2}{3}$ A1

$\dfrac{4\left(1-\left(\frac{2}{3}\right)^5\right)}{\frac{1}{3}}$ M1

$\dfrac{844}{81}$ A1

### Question 9

4 marks

**Answer:** (a) $406$ cm; (b) $500$ cm

**(a)**

$\dfrac{40(1-0.92^{20})}{0.08}$ M1

$406$ cm A1

**(b)**

$\dfrac{40}{0.08}$ M1

$500$ cm A1

### Question 10

6 marks

**Answer:** (a) $8$; (b) $4$

**(a)**

Substitute into $S_\infty = \frac{u_1}{1-r}$:

$S_\infty = \frac{6}{1-\frac{1}{4}}$ M1

$S_\infty = \frac{6}{\frac{3}{4}} = 8$ A1

**(b)**

Substitute $S_\infty = 8$:

$\log_k(8+8) = \log_k 16 = 2$ A1

Convert to exponential form:

$k^2 = 16$ M1

$k = \pm 4$, but a logarithm base must be positive (and not 1), so reject $k = -4$ R1

$k = 4$ A1

Every solution is also on ibmathrevision.com/hlai/logs-and-infinite-geometric-series-exam-practice
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