Year 11 Mathematics Advanced

Topic: Exponential and Logarithmic Functions (1 of 4)
Review Questions: Exponential functions and Euler's number
Term 3, 2026

How to use this review set

These are real past-paper questions, grouped by question pattern. The grey label on each question shows where it is from and its marks.

- The questions are grouped by the pattern that keeps coming up in exams, a few of each in a row, running from the plainer patterns into the harder ones near the end. Work through them and you will meet every type an exam can throw at you.
- This set **is your diagnostic**. Working through it shows you exactly which patterns are solid and which need work. Attempt every question properly in your own book, and go back to your notes to help you work through tough questions if needed.
- Every question you get wrong, need help with or struggle with goes in your **Mistakes Log**, which you should be working on daily to get you exam-ready.

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Exponential expressions and Euler's number

1. Evaluating exponential expressions and Euler's number e

Q1 Girraween 2021 Trial Q1 · **1 mark**

What is the value of $8e^{-2}$ correct to 2 significant figures?

Q2 Moriah 2021 Prelim Q11(a) · **1 mark**

Find the value of $e^{-1.75}$ correct to 3 significant figures.

Q3 North Sydney Girls 2023 Trial Q1 · **1 mark**

What is the value of $\dfrac{9.52}{e^{-3.8}}$ to three significant figures?

Q4 Cherrybrook Tech 2022 Prelim Q17(a) · **1 mark**

A function is defined as $f(x) = 4 - 2^{-x}$.

(a) Find the value of $f(-2)$.

Q5 Kambala 2024 Prelim Q17(a) · **1 mark**

For the function $f(x) = 4e^{3x}$.

(a) Find the exact value of $f(2)$.

Q6 Sydney Girls 2020 Trial Q6 · **1 mark**

If $f(x) = b^x + b^{-x}$, then $\big(f(-x)\big)^2 =$

(A) $f(2x) - 1$

(B) $2 + f(2x)$

(C) $f(2x) - 2$

(D) $2 - f(2x)$

Q7 Gosford 2023 Prelim Q19 · **3 marks**

Let $f(x) = 1 + e^{2x}$.

Show that $f(x) \times f(-x) = f(x) + f(-x)$.

Solving exponential equations

2. Basic exponential equations (common base)

Q8 Sydney Boys 2022 Trial Q11 · **1 mark**

Solve $2^x = \dfrac{1}{16}$.

Q9 Girraween 2021 Prelim Q1(bi) · **1 mark**

Solve for x:

$$\left(\frac{2}{3}\right)^x = \frac{27}{8}$$

Q10 Pymble 2022 Prelim Q22(c) · **2 marks**

Solve $2^{x-3} = \dfrac{1}{4}$.

Q11 Baulkham Hills 2022 Prelim Q22 · **2 marks**

Solve for x, $3^{1-x} = \dfrac{1}{\sqrt{27}}$.

Q12 Baulkham Hills 2023 Prelim Q12 · **2 marks**

Solve $5^{-3x} = 125^{x+1}$.

Q13 Hurlstone 2024 Prelim Q28 · **2 marks**

Solve $\left(\sqrt{3}\right)^x = 9^{2x}$, leaving x in exact form.

Q14 Moriah 2021 Prelim Q11(c) · **3 marks**

Find the value of y that solves $\left(\sqrt{8}\right)^{y-3} = (64)^{4-y}$.

3. Exponential equations using logarithms

Q15 Trinity Grammar 2020 Trial Q11 · **1 mark**

Find the exact value of x if $17^x = 2$.

Q16 Normanhurst Boys 2025 Trial Q4 · **1 mark**

What is the solution of $3^x = 5$?

(A) $\dfrac{\log 5}{3}$

(B) $\dfrac{3}{\log 5}$

(C) $\dfrac{\log 5}{\log 3}$

(D) $\log\left(\dfrac{5}{3}\right)$

Q17 St George Girls 2022 Prelim Q10 · **2 marks**

Solve $2^x = 5$ correct to 3 significant figures.

Q18 St George Girls 2023 Prelim Q10 · **2 marks**

Solve for x: $2^{x-3} + 2 = 7$, leave your answer correct to 2 decimal places.

Q19 Kambala 2021 Prelim Q7(a) · **2 marks**

Solve $2^x = 30$, correct to two decimal places.

Q20 Girraween 2022 Trial Q11 · **3 marks**

Solve $3^{2x-1} = 5^x$, giving your answer to 2 d.p.

Q21 Presbyterian 2022 Prelim Q14 · **2 marks**

Solve $3^{2x} = 2^{x+1}$.

Q22 Hornsby Girls 2022 Prelim Q24 · **2 marks**

By taking logarithms of both sides, or otherwise, solve $2 \times 3^{x-2} = 36^{x-1}$, expressing your answer correct to 2 decimal places.

4. Exponential equations reducible to a quadratic

Q23 Trinity Grammar 2020 Trial Q15 · **3 marks**

Solve the equation $4(4^x) - 5(2^x) + 1 = 0$.

Q24 Normanhurst Boys 2023 Trial Q3 · **1 mark**

Which of the following represents the solutions for the equation $2^{2x} - 5(2^x) + 4 = 0$?

(A) $x = 0$ or $x = 1$

(B) $x = 0$ or $x = 2$

(C) $x = \log_2 1$ or $x = \log_2 2$

(D) $x = 1$ or $x = 4$

Q25 Riverview 2022 Trial Q8 · **1 mark**

The solutions to $e^{6x} - 5e^{3x} + 6 = 0$ are $x =$

(A) $2,\ 3$

(B) $\log_e 2,\ \log_e 3$

(C) $e^{2x},\ e^{3x}$

(D) $\frac{1}{3}\log_e 3,\ \frac{1}{3}\log_e 2$

Q26 Blacktown Boys 2022 Prelim Q17(b) · **3 marks**

Solve the following equation to find the exact value of x.

$$3 \times 9^x - 13 \times 3^x + 4 = 0$$

Q27 North Sydney Boys 2022 Trial Q21 · **3 marks**

Solve the following equation for x.

$$5^x - \frac{8}{5^x} = 2$$

Q28 Baulkham Hills 2022 Trial Q28 · **3 marks**

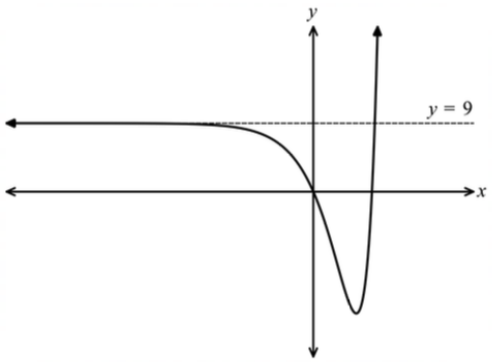
Solve $4^x - 2^{x+2} = 32$.

Q29 Sydney Grammar 2023 Trial Q22 · **3 marks**

Solve the equation $9^x - 3^{x+1} = -2$, leave your answers in exact form.

Q30 Killara 2024 Prelim Q32(a) · **3 marks**

The graph of $f(x) = 3^{2x} - 10(3^x) + 9$ is shown below.



(a) Find the x-intercepts using an algebraic method.

Exponential growth and decay models

5. Exponential growth and decay models

Q31 Presbyterian 2022 Prelim Q31 · **3 marks**

The population of an ant colony is modelled by the equation

$$P = 1000e^{0.34t},$$

where t is measured in weeks.

(a) Find the population after 10 weeks (answer to the nearest 10).

(b) When will the population exceed 80 000 ants?

Q32 Hornsby Girls 2022 Prelim Q19 · **4 marks**

In a yeast culture, cell numbers are given by

$$N = 100 \times (2.7)^{1.03t},$$

where t is measured in hours after the cells are introduced to the culture.

(a) What is the initial number of cells?

(b) How many cells, correct to the nearest whole number, will be present after 6 hours?

(c) How long will it take for the population to reach one million cells? Give your answer correct to the nearest hour.

Q33 Girraween 2022 Prelim Q12(a) · **5 marks**

A tank initially has 3000 litres of water and is leaking according to the formula

$$V = V_0\, e^{-0.135t},$$

where t is in hours.

(a) Find the value of V_0.

(b) Find the value of V after 5 hours. Give your answer correct to 1 decimal place.

(c) Find the time taken for the volume of water to fall to 250 litres. Give your answer to the nearest minute.

Q34 Girraween 2021 Prelim Q1(d) · **5 marks**

The number of bacteria growing in a Petri dish triples every two hours. Initially there were 50 bacteria.

(a) Find the value of x so that P is the bacteria population after n hours, where

$$P = 50 \times 3^{\frac{n}{x}}.$$

(b) How many bacteria are there after 13 hours?

(c) How long, to the nearest hour, will it take for the bacteria population to reach 1 000 000?

Q35 Girraween 2023 Prelim Q10(d) · **4 marks**

The population of a city is given by

$$P = 35\,000e^{0.024t},$$

where t is time in years.

(a) Find the population after 10 years.

(b) Find when the population will reach 200 000.

Q36 Loreto Kirribilli 2022 Prelim Q30 · **6 marks**

A city's population is experiencing exponential growth such that the population P at time t in years can be given by

$$P = 50\,000e^{at},$$

where a is a positive constant.

(a) What is the initial population of the city?

(b) If the population is 52 400 after 1 year, find the value of a to 4 decimal places.

(c) Find the average rate of growth of the population in the first 5 years, correct to 1 decimal place.

Q37 Abbotsleigh 2024 Prelim Q19 · **3 marks**

At time t years after it was purchased, the value \$$V$ of a car is given by

$$V = 40\,000e^{-0.4t}.$$

Find, in years and months, correct to the nearest month, the time taken for the value of the car to fall to \$1000.