Year 11 Mathematics Advanced

Topic: Trigonometric Identities and Equations (1 of 3)
Review Questions: Reciprocal ratios and trigonometric identities
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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Reciprocal ratios and exact values

1. Exact reciprocal ratios (sec, cosec, cot) and evaluation

Q1 Gosford 2020 Trial Q1 · 1 mark

What is the value of $\operatorname{cosec}\frac{\pi}{3}$ to three significant figures?

(A) 1.00

(B) 1.15

(C) 1.41

(D) 2.00

Q2 International Grammar 2021 Prelim Q5 · 1 mark

What is the exact value of $\sin 135° + \operatorname{cosec} 60°$?

(A) $\dfrac{2\sqrt{2}-\sqrt{3}}{\sqrt{6}}$

(B) $\dfrac{2\sqrt{2}-1}{\sqrt{2}}$

(C) $\dfrac{2\sqrt{2}+\sqrt{3}}{\sqrt{6}}$

(D) $\dfrac{2\sqrt{2}+1}{\sqrt{2}}$

Q3 Blacktown Boys 2022 Prelim Q12 · 2 marks

Find the exact value of $\sec\frac{4\pi}{3}\cot\frac{4\pi}{3}$.

Q4 Cherrybrook Tech 2022 Prelim Q11 · 2 marks

What is the exact value of $\cot 240° \cos 120°$?

Q5 Barker 2021 Prelim Q12(c) · 2 marks

Find the value of $\sin\frac{\pi}{3} + \sec\frac{\pi}{4}$. Leave your answer as a single fraction in exact form.

2. Finding an exact ratio given another ratio and quadrant

Q6 Presbyterian 2021 Trial Q3 · **1 mark**

If $\tan\theta = -\frac{2}{3}$ and $\frac{\pi}{2} < \theta < \pi$. What is the value of $\sec\theta$?

(A) $-\frac{3}{\sqrt{13}}$

(B) $-\frac{\sqrt{13}}{3}$

(C) $-\frac{\sqrt{13}}{2}$

(D) $-\frac{2}{\sqrt{13}}$

Q7 Knox 2021 Prelim Q7 · **1 mark**

If $\cos\theta = -\frac{12}{13}$ and $180° \leq x \leq 360°$, find $\cot\theta$.

(A) $-\frac{12}{5}$

(B) $-\frac{5}{12}$

(C) $\frac{5}{12}$

(D) $\frac{12}{5}$

Q8 Cherrybrook Tech 2021 Prelim Q14 · **1 mark**

Given $\sin\theta = \frac{7}{12}$ for an obtuse angle θ, find the exact value of $\cos\theta$.

Q9 Killara 2021 Prelim Q15 · **2 marks**

If $\sin\theta = \frac{4}{7}$, find the exact value of $\sec\theta$.

Q10 Sydney Girls 2021 Prelim Q3(b) · **2 marks**

If $\sin A = -\frac{1}{3}$ and $\tan A < 0$. Find $\sec A$.

Q11 North Sydney Boys 2020 Trial Q22 · **2 marks**

Find the exact value of $\cot\theta$ given that $\cos\theta = 0.6$ and $\sin\theta < 0$.

Q12 Barker 2025 Trial Q19 · **2 marks**

Given that $\cos\theta = -\frac{2}{7}$ and $\frac{\pi}{2} \leq \theta \leq \pi$, find the exact value of $\operatorname{cosec}\theta$.

Q13 James Ruse 2020 Trial Q19(a) · **2 marks**

Find $\tan A$ if $\operatorname{cosec} A = -\frac{13}{12}$ and $\sec A > 0$.

Q14 Sydney Girls 2023 Trial Q10 · **1 mark**

If $\tan^2\theta = 1 - e^2$, then the value of $\sec\theta + \tan^3\theta \operatorname{cosec}\theta$ is equal to:

(A) $\left(2 + e^2\right)^{\frac{3}{2}}$

(B) $\left(2 - e^2\right)^{\frac{3}{2}}$

(C) $\left(2 + e^2\right)^{\frac{1}{2}}$

(D) $\left(2 - e^2\right)^{\frac{1}{2}}$

Working with identities

3. Simplifying expressions using identities

Q15 Abbotsleigh 2021 Trial Q11(b) · 1 mark

Simplify $1 + \tan^2 x$.

Q16 Fort St 2022 Prelim Q3 · 1 mark

Simplify the expression $\sec x \sin x$.

(A) $\operatorname{cosec} x$

(B) $\cos x$

(C) $\tan x$

(D) 1

Q17 Riverview 2024 Trial Q19 · 1 mark

Simplify $\dfrac{\sin^2 x + \cos^2 x}{\cos^2 x}$.

Q18 Trinity Grammar 2020 Trial Q3 · 1 mark

Which expression is equivalent to $\tan\theta + \cot\theta$?

(A) $\operatorname{cosec}\theta + \sec\theta$

(B) $\sec\theta \operatorname{cosec}\theta$

(C) 1

(D) 2

Q19 St George Girls 2021 Prelim Q1(b) · 2 marks

Simplify the following expression: $\dfrac{1 - \cos^2\theta}{\tan\theta}$.

Q20 Moriah 2021 Prelim Q8 · 2 marks

Simplify $\dfrac{\cos x - \cos^3 x}{\sin^3 x}$.

Q21 Riverview 2022 Trial Q19 · **2 marks**

Expand and simplify $(\text{cosec } A + 1)(\text{cosec } A - 1)$.

Q22 Blacktown Boys 2024 Trial Q9 · **1 mark**

Which of the following is equivalent to $\dfrac{\tan^2 x - 1}{\tan^2 x + 1}$?

(A) $1 - 2\cos^2 x$

(B) $1 - \sec^2 x$

(C) $\dfrac{1}{\sin^2 x - \cos^2 x}$

(D) $\sec^2 x - \text{cosec}^2 x$

Q23 Killara 2022 Prelim Q34(b) · **3 marks**

For an angle θ, where $\pi \leq \theta \leq 2\pi$, $\cos\theta = \dfrac{2}{3}$. It can be shown that $\sin\theta = -\dfrac{\sqrt{5}}{3}$.

Simplify the following expression, leaving your answer in the form $a\sqrt{5} + b$, where a and b are real numbers.

$$\frac{\cos\theta + 2\sin\theta}{\tan\theta - 3\sin\theta}$$

4. Simplifying and evaluating with related and complementary angles

Q24 Manly 2021 Trial Q3 · **1 mark**

Which of the following is the same as $\text{cosec}(\pi + \theta)$?

(A) $-\dfrac{1}{\sin\theta}$

(B) $-\dfrac{1}{\cos\theta}$

(C) $\dfrac{1}{\cos\theta}$

(D) $\dfrac{1}{\sin\theta}$

Q25 Shore 2023 Prelim Q7 · **1 mark**

Which of the following is a simplified form of $-\sec(180° - \theta)\sin\theta$?

(A) $-\tan\theta$

(B) $\tan\theta$

(C) 1

(D) -1

Q26 Merewether 2025 Trial Q2 · **1 mark**

Which expression is equivalent to $\cos^2\left(\frac{\pi}{2} - \theta\right)\cot\theta$?

(A) $\cos^2\theta\,\cot\theta$

(B) $\sin\theta\cos\theta$

(C) $\dfrac{\sin^3\theta}{\cos\theta}$

(D) $\sin^2\theta\,\cot\theta$

Q27 Killara 2021 Prelim Q8 · **2 marks**

Fully simplify

$$\frac{\sin 33° + \cos 57°}{\cos 57°}$$

Q28 Knox 2023 Prelim Q29 · **2 marks**

Simplify completely $\cos(\pi + \theta)\cos(\pi - \theta) - 1$.

Q29 Sydney Grammar 2022 Prelim Q7 · **1 mark**

Which of the following is a simplified form of

$$\frac{\sec(180° - \theta)}{\tan(360° - \theta)}\,?$$

(A) $-\sin\theta$

(B) $-\operatorname{cosec}\theta$

(C) $\sin\theta$

(D) $\operatorname{cosec}\theta$

Q30 Killara 2023 Prelim Q24 · **3 marks**

Fully simplify the following expression.

$$\frac{\sin\theta}{\cos 60^\circ} + \frac{\cos(270^\circ - \theta)}{\tan 45^\circ}$$

5. Proving identities

Q31 Hurlstone 2020 Trial Q34 · **2 marks**

By expressing $\sec\theta$ and $\tan\theta$ in terms of $\sin\theta$ and $\cos\theta$, show that

$$\sec^2\theta - \tan^2\theta = 1.$$

Q32 Hornsby Girls 2021 Prelim Q12 · **2 marks**

Prove: $\tan x + \cot x = \sec x \operatorname{cosec} x$.

Q33 Hunters Hill 2023 Trial Q17 · **2 marks**

Prove that $(\sec x + \tan x)(\sec x - \tan x) = 1$.

Q34 North Sydney Boys 2022 Trial Q17 · **2 marks**

Show that $\cot A + \dfrac{\sin A}{1 + \cos A} = \operatorname{cosec} A$.

Q35 2020 HSC Q19 · **2 marks**

Prove that $\sec\theta - \cos\theta = \sin\theta\tan\theta$.

Q36 Baulkham Hills 2024 Trial Q17 · **2 marks**

Prove $\dfrac{1}{\sec x - \tan x} + \dfrac{1}{\sec x + \tan x} = 2\sec x$.

Q37 Sydney Tech 2023 Trial Q15 · **3 marks**

Prove that $\sin^4\theta - \cos^4\theta = 2\sin^2\theta - 1$.

Q38 Penrith 2023 Prelim Q29 · **3 marks**

Prove that $\dfrac{1+\cos\varphi}{1-\cos\varphi} - \dfrac{1-\cos\varphi}{1+\cos\varphi} = 4\cot\varphi\ \operatorname{cosec}\varphi$.

Q39 2025 HSC Q22 · **2 marks**

Prove that

$$\frac{\sin^4\theta + \cos^4\theta}{\sin^2\theta\cos^2\theta} + 2 = \sec^2\theta\ \operatorname{cosec}^2\theta.$$

Q40 Sydney Girls 2024 Trial Q28 · **3 marks**

Prove that $(\cot\theta + \operatorname{cosec}\theta)^2 = \dfrac{1+\cos\theta}{1-\cos\theta}$.