Year 11 Mathematics Advanced

Topic: Working with Functions (12 of 12)
Review Questions: Mixed One-off Exam Questions
Term 3, 2026

How to use this set

These are real past-paper questions on working with functions that do not fit any one recurring pattern: genuine one-offs. They are here so you also meet the rarer, less predictable exam questions. Work through them once you are solid on the patterns in the main review docs. Every question you get wrong or struggle with goes in your **Mistakes Log**.

Mixed one-off exam questions

Q1 Girraween 2023 Prelim Q6(a) · **1 mark**

Evaluate, correct to 3 significant figures:

$$\frac{2.13 - 29}{4.01^2 - 0.8^2}.$$

Q2 Sydney Girls 2020 Trial Q25 · **3 marks**

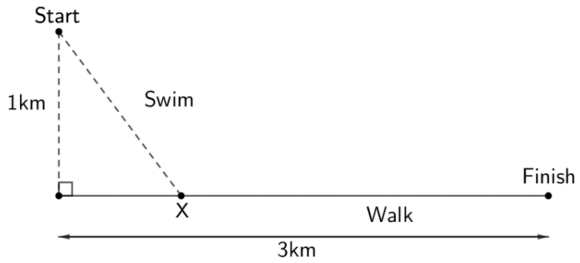
Consider the graphs of $y = |x|$ and $y = 1 - x^2$.

(a) On the same axes, sketch the graphs of $y = |x|$ and $y = 1 - x^2$.

(b) Shade the region where *both* $y \geq |x|$ and $y \leq 1 - x^2$.

Q3 Barker 2021 Trial Q33(a) · **1 mark**

Deliah is in the water 1 km off the coast and wants to get to a town 3 km down the coast. She needs to swim to shore and then walk to the town. Deliah can swim at 2 km/hour and walk at 4 km/hour.
How long will it take Deliah to swim the 1 km to shore and then walk the 3 km to town?



Q4 Sydney Grammar 2021 Prelim Q4 · **1 mark**

Which of the following describes the relation $y = |x - 3|$?

(A) one-to-one

(B) one-to-many

(C) many-to-one

(D) many-to-many

Q5 Sydney Grammar 2022 Trial Q29 · **2 marks**

Consider the exact values $\sin\frac{\pi}{8} = \frac{\sqrt{2-\sqrt{2}}}{2}$ and $\cos\frac{\pi}{8} = \frac{\sqrt{2+\sqrt{2}}}{2}$.

Show that $-\sin\frac{\pi}{8} - \cos\frac{\pi}{8} = -\frac{\sqrt{4+2\sqrt{2}}}{2}$.

Q6 Sydney Boys 2023 Trial Q11 · **2 marks**

Make b the subject of the formula $a(b+5) = 2a + b$.

Q7 Penrith 2022 Prelim Q18 · **2 marks**

Describe the following solution set using interval notation.

Diagram to be inserted:
`adv-working-with-functions-d12-q7.png`

Q8 Penrith 2022 Prelim Q28 · **2 marks**

Explain the difference between a one-to-one function and a many-to-one function, and provide an example of each.

Q9 Manly 2024 Trial Q12 · **2 marks**

The domains of two continuous functions, $f(x)$ and $g(x)$, are $[-3, 2)$ and $(0, 6]$ respectively. What is the domain of the sum function $f(x) + g(x)$?

Q10 Hurlstone 2021 Prelim Q15 · **1 mark**

For what values of x is the function $f(x) = \frac{1}{x^2 - 4x}$ not continuous?

(A) $x = 0,\ x = 4$

(B) $0 < x < 4$

(C) $x < 0,\ x > 4$

(D) Continuous for all values of x

Q11 Baulkham Hills 2021 Prelim Q9 · **1 mark**

Below is an incomplete graph of the relation $y = f(x)$. What lies on the left of the y-axis has been obstructed from view.

Diagram to be inserted:
`adv-working-with-functions-d12-q11.png`

Given that $f(x)$ is an odd function, what type of relation is $y = f(x)$?

(A) One-to-one

(B) One-to-many

(C) Many-to-one

(D) Many-to-many

Q12 Hurlstone 2024 Prelim Q2 · **1 mark**

Given a set of coordinates $(-4, -2)$, $(-4, -5)$, $(-1, 0)$, $(3, -2)$ and $(5, -1)$, which of the following best describes this relation?

(A) One-to-one

(B) One-to-many

(C) Many-to-one

(D) Many-to-many

Q13 Baulkham Hills 2021 Prelim Q5 · **1 mark**

The points $P(3, 1)$, $Q(2, 5)$ and $R(a, b)$ are collinear. Which of the following statements is correct?

(A) $a + 4b = 7$

(B) $a - 4b = -1$

(C) $4a + b = 13$

(D) $4a - b = 11$

Q14 Killara 2023 Trial Q14(b) · **2 marks**

The owners of Wilson Tennis Racquets use the equation $pq = T$, where p is the price of a racquet, q is the quantity sold per year and T is a constant. Given that a racquet priced at $p = \$100$ sold a quantity of $q = 4000$ (so that $T = 400\,000$), sketch the graph of the demand curve with q on the horizontal axis and p on the vertical axis.

Q15 Sydney Tech 2021 Trial Q38(a) · **2 marks**

Two straight roads meet at R at an angle of 90°. At time $t = 0$ car A leaves R on one road, and car B is 100 km from R on the other road. Car A travels away from R at a speed of 80 km/h, and car B travels towards R at a speed of 60 km/h. The distance between the cars at time t hours is r km. Show that $r^2 = 2000(5t^2 - 6t + 5)$.

Diagram to be inserted:
`adv-working-with-functions-d12-q15.png`

Q16 North Sydney Girls 2020 Trial Q7 · **1 mark**

The maximum speed of a train going up a hill is inversely proportional to the square root of its weight. A train weighing 3600 tonnes can go up a hill at 30 km/h. What is the maximum speed at which a train weighing 2500 tonnes could go up the same hill?

(A) 43.2 km/h

(B) 36 km/h

(C) 25 km/h

(D) 20.8 km/h

Q17 Abbotsleigh 2024 Prelim Q18(b) · **1 mark**

A function $f(x)$ is defined by

$$f(x) = \begin{cases} 2x & \text{for } x > 1, \\ 1 - x^2 & \text{for } -1 \le x \le 1, \\ -(2 + x) & \text{for } x < -1. \end{cases}$$

Explain why this is no longer a function if the third part of the definition is changed to $-(2 + x)$ for $x \le 1$.

Q18 Girraween 2023 Prelim Q8(a) · **6 marks**

Consider the piecewise-defined function

$$f(x) = \begin{cases} x^2 - 1 & \text{for } x \leq 1, \\ 4 - x^2 & \text{for } x > 1. \end{cases}$$

(i) Find $f(2) + f(0)$.

(ii) Find the values of the x-intercepts of $f(x)$.

(iii) Sketch the function showing all intercepts with the axes.

Q19 St George Girls 2021 Prelim Q8(a)(i) · **1 mark**

Let $f(x) = |x - 2|$. Explain why this function is continuous at $x = 2$.

Q20 Knox 2022 Prelim Q14(c) · **2 marks**

In the right-angled triangle below, the two shorter sides have lengths $3 - \sqrt{5}$ and $\sqrt{3} + \sqrt{15}$. Find the exact length of the side marked x.

Diagram to be inserted:
`adv-working-with-functions-d12-q20.png`

Q21 Penrith 2023 Prelim Q14 · **5 marks**

It is given that $p = \sqrt{19} - 3\sqrt{2}$.

(a) Expand $\left(p - \dfrac{1}{p}\right)^2$.

(b) Show that $p - \dfrac{1}{p} = -6\sqrt{2}$.

(c) Hence, find the value of $p^2 + \dfrac{1}{p^2}$.

Q22 North Sydney Girls 2023 Trial Q28 · **5 marks**

The diagram below shows the graphs of two functions $f(x)$ and $g(x)$. It is known that $g(x)$ is a transformation of $f(x)$.

Diagram to be inserted:
`adv-working-with-functions-d12-q22.png`

(a) List the sequence of transformations applied to $f(x)$ to give $g(x)$.

(b) Let $u(x) = f(x)\,g(x)$. Find the value of $u'(1)$.

Q23 Baulkham Hills 2021 Prelim Q10 · **1 mark**

The straight lines $ax + by + c = 0$ and $dx - ey - f = 0$ are perpendicular, where the coefficients a, b, c, d, e, f are real and non-zero. Which of the following statements is correct?

(A) $ad - be = 0$

(B) $ad + be = 0$

(C) $ae - bd = 0$

(D) $ae + bd = 0$

Q24 2022 HSC Q31(a) · **2 marks**

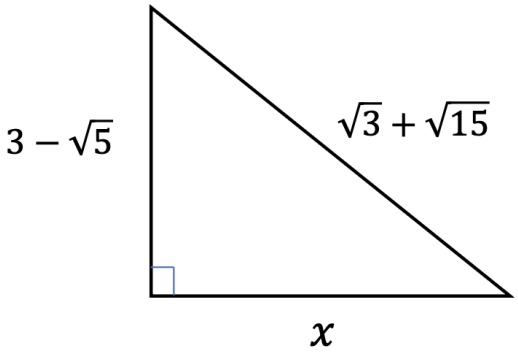
A line passes through the point $P(1, 2)$ and meets the axes at $X(x, 0)$ and $Y(0, y)$, where $x > 1$.

Diagram to be inserted:
`adv-working-with-functions-d12-q24.png`

Show that $y = \dfrac{2x}{x-1}$.

Q25 Hornsby Girls 2023 Trial Q28(b) · **2 marks**

The parabola $x = ay^2$ passes through the points $(0, 0)$ and $(1, \sqrt{3})$. Find the value of a and show that the upper half of the parabola has equation $y = \sqrt{3}\sqrt{x}$.



Q26 Fort St 2023 Trial Q11 · **3 marks**

Part of the graph of the function $y = \dfrac{a}{x-b} + c$ is shown below.

Diagram to be inserted:
`adv-working-with-functions-d12-q26.png`

Find the values of a, b and c.

Q27 Hurlstone 2022 Prelim Q12(c) · **5 marks**

Consider the function $y = \dfrac{2x^2 + x - 1}{x^2 - 1}$.

(i) Show that $\dfrac{2x^2 + x - 1}{x^2 - 1} = 2 + \dfrac{1}{x-1}$.

(ii) Use the result in part (i) to help sketch a neat graph of

$$y = \frac{2x^2 + x - 1}{x^2 - 1},$$

labelling any intercepts, discontinuities and other key features.

Q28 Penrith 2022 Prelim Q30 · **3 marks**

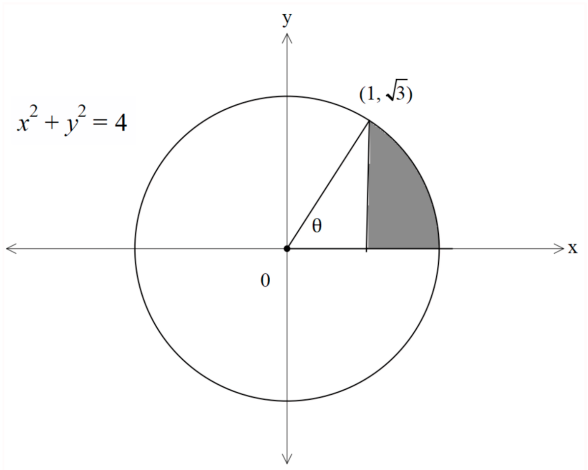
A cyclist goes up a long slope at a constant speed of 15 km/h. He turns around and comes down the slope at a constant speed of 40 km/h. Find his average speed over a full circuit.

Q29 Penrith 2022 Prelim Q20 · **3 marks**

A group of friends hire a bus for \$2100 to take them to a music festival. Seven friends can no longer make the festival and withdraw from the bus hire. The remaining friends must each pay an additional \$10 to cover the cost of the bus hire. How many friends originally agreed to go on the bus?

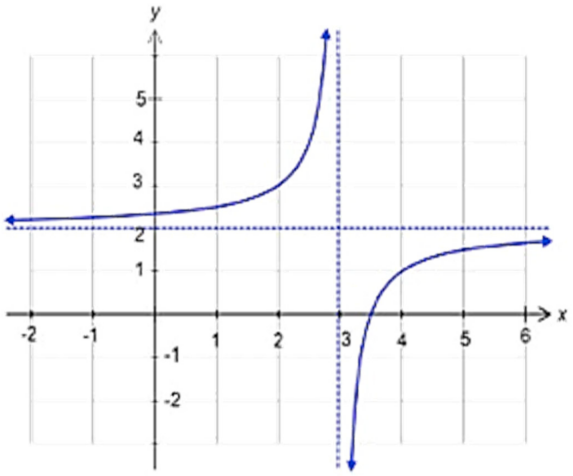
Q30 Sydney Boys 2022 Trial Q29(a) · **3 marks**

Relative to a suitable set of coordinate axes, the line $2x-y+5=0$ intersects the circle $x^2+y^2-6x-2y-30=0$ at the points P and Q. Given that the coordinates of P are $(-3,-1)$, find the coordinates of Q.



Q31 Merewether 2025 Trial Q33(a) · **2 marks**

A circle centred at A with radius 1 unit intersects the parabola $y = 2x^2$ at the origin O and at the point B, as shown in the diagram. The line ℓ passes through O and B.



Show that the coordinates of B are $\left(\frac{\sqrt{3}}{2}, \frac{3}{2}\right)$.

Q32 Normanhurst Boys 2021 Trial Q8 · **1 mark**

The circle $x^2 + y^2 - 4x - 4y + c = 0$ touches both the x-axis and the y-axis. What is the value of c?

(A) $c = 1$

(B) $c = 2$

(C) $c = 4$

(D) $c = 8$

Q33 Manly 2023 Trial Q30(c) · **2 marks**

The graph of $y = h(x)$ is shown below. The graph is symmetrical about the line $x = 2$, and passes through $A(0, 3)$ and $B(2, 0)$.

Diagram to be inserted:
`adv-working-with-functions-d12-q33.png`

Find the number of solutions to the equation

$$h(x) + h(x + 2) = 3.$$

Q34 Baulkham Hills 2023 Trial Q28(c) · **1 mark**

The graph below shows $y = \dfrac{9}{2x + 1}$ together with $y = 5 - 2|x + 2|$. The point of intersection of the two graphs is $(-5, -1)$.

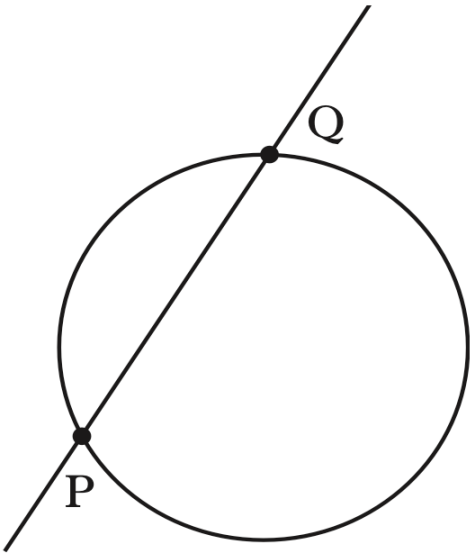
Diagram to be inserted:
`adv-working-with-functions-d12-q34.png`

Hence or otherwise solve

$$\frac{9}{2x + 1} < 5 - 2|x + 2|.$$

Q35 North Sydney Boys 2024 Trial Q31(i) · **2 marks**

The function $y = \dfrac{x}{x^2+1}$ is shown below. It is an odd function.



For what values of m do the line $y = mx$ and the curve $y = \dfrac{x}{x^2+1}$ enclose a region?

Q36 James Ruse 2025 Trial Q12(b) · **3 marks**

A circle has equation $x^2 + 4x + y^2 + 2y + 4 = 0$. The line $y = mx + 2$ is a tangent to the circle. Determine the values of m.

Q37 Sydney Boys 2025 Trial Q38 · **3 marks**

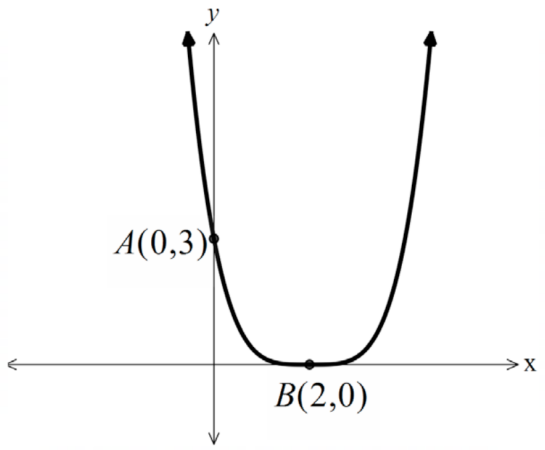
Let n be an integer.

(a) Find the value of μ such that $n(n+1)(n+2)(n+3) = (n^2+\mu n)(n^2+\mu n+2)$.

(b) Hence deduce that $2022 \times 2023 \times 2024 \times 2025 + 1$ is a perfect square.

Q38 Sydney Girls 2025 Trial Q10 · **1 mark**

The straight line with equation $y = ax + 3$, where $a > 1$, is perpendicular to the line with equation $y = bx + 2$. The lines cut the x-axis at the points L and M respectively. The length of LM is 5 units.



What is the value of $a + b$, given that $a > 1$?

(A) $-\frac{13}{6}$

(B) $\frac{13}{6}$

(C) $-\frac{5}{6}$

(D) $\frac{5}{6}$