Year 11 Mathematics Advanced

Topic: Working with Functions (8 of 12)
Review Questions: Circles and Semicircles
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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Centre, radius and equations

1. Centre and radius from standard form and completing the square

Q1 Sydney Grammar 2023 Prelim Q9(b) · **1 mark**

Write down the centre and radius of the circle with equation $(x-1)^2 + y^2 = 4$.

Q2 North Sydney Boys 2024 Prelim Q8 · **2 marks**

Find the centre and radius of the circle represented by the equation $x^2 - 6x + y^2 + 10y + 18 = 0$.

Q3 Presbyterian 2023 Prelim Q14 · **2 marks**

Find the centre and radius of the circle represented by the equation $x^2 - 4x + y^2 + 6y + 4 = 0$.

Q4 Baulkham Hills 2024 Prelim Q16 · **2 marks**

State the centre and radius of the circle $2x^2 + 2y^2 - 12y - 4 = 0$.

Q5 Girraween 2023 Prelim Q8(c) · **3 marks**

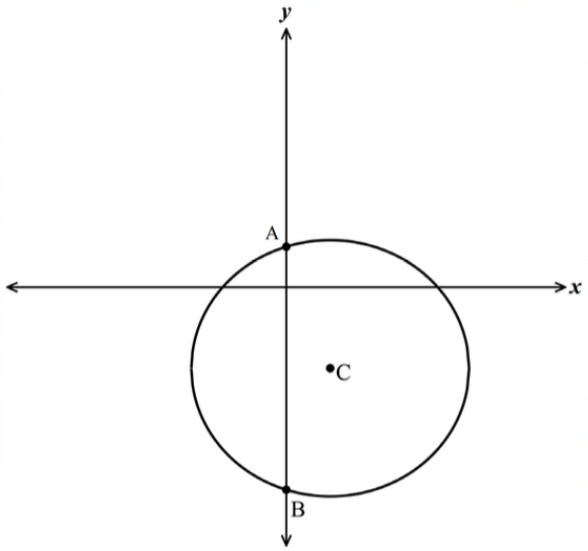
A circle has the equation $x^2 + y^2 - 5x + 3y - 1 = 0$. Find the radius and centre of the circle.

Q6 Penrith 2023 Prelim Q28 · **2 marks**

Give reasons why $x^2 + 4x + y^2 - 6y + 15 = 0$ is not an equation of a circle.

Q7 Killara 2023 Prelim Q27 · **6 marks**

The equation of a circle is given by $4x^2 + 4y^2 - 4x + 8y - 5 = 0$. It is given that the circle cuts the y-axis at two points A and B respectively as shown on the diagram below.



(a) Show that the centre C has the coordinates $\left(\frac{1}{2}, -1\right)$.

(b) Find the radius of this circle.

(c) Hence, or otherwise, show that $\angle ACB$ is obtuse.

2. Domain and range of circles and semicircles

Q8 Baulkham Hills 2022 Prelim Q1 · **1 mark**

What is the domain and the range of the function $f(x) = \sqrt{4 - x^2}$?

(A) Domain: $[-2, 2]$, Range: $[-2, 2]$

(B) Domain: $[-2, 2]$, Range: $[0, 2]$

(C) Domain: $[0, 2]$, Range: $[-4, 4]$

(D) Domain: $[0, 2]$, Range: $[0, 4]$

Q9 Fort St 2021 Prelim Q2(b)(i) · **2 marks**

Consider $f(x) = \sqrt{18 - x^2}$. State the domain and range of $f(x)$.

Q10 Girraween 2023 Prelim Q7(b) · **2 marks**

Find the domain and range of the function $y = -\sqrt{\frac{25}{16} - x^2}$.

Q11 Hornsby Girls 2022 Trial Q1 · **1 mark**

What is the range of the function $y = -2\sqrt{16 - x^2}$?

(A) $(-\infty, -8]$

(B) $[-4, 0]$

(C) $[-8, 0]$

(D) $[-8, \infty)$

Q12 Riverview 2023 Trial Q5 · **1 mark**

What is the domain and range of a circle with the equation $x^2 + 6x + y^2 = 7$?

(A) domain $= [-3 - \sqrt{7},\ -3 + \sqrt{7}\,]$; range $= [-\sqrt{7}, \sqrt{7}\,]$

(B) domain $= [3 - \sqrt{7},\ 3 + \sqrt{7}\,]$; range $= [-\sqrt{7}, \sqrt{7}\,]$

(C) domain $= [-1, 7]$; range $= [-4, 4]$

(D) domain $= [-7, 1]$; range $= [-4, 4]$

Q13 Knox 2023 Prelim Q17 · **5 marks**

The circle $(x - 2)^2 + (y + 1)^2 = 4$ is reflected in the y-axis.

(a) Sketch the new circle on a number plane.

(b) Write down the equation of your new circle.

(c) Write down the domain and range of your new circle.

Graphs, domain and range

3. Identify or sketch a circle/semicircle from its equation or graph

Q14 Sydney Tech 2021 Trial Q7 · **1 mark**

The circle shown in the diagram has the equation given by one of the options below.

Diagram to be inserted:
`adv-working-with-functions-d8-q14.png`

Which of the following is the equation for the circle shown in the diagram above?

(A) $x^2 + 6x + y^2 + 2y + 1 = 0$

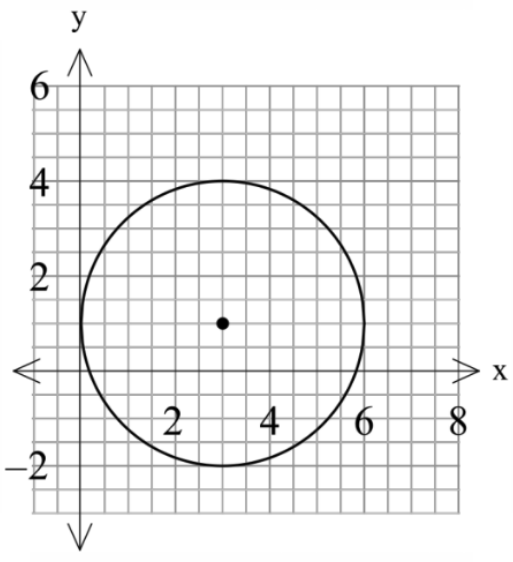
(B) $x^2 - 6x + y^2 + 2y - 1 = 0$

(C) $x^2 - 6x + y^2 - 2y + 1 = 0$

(D) $x^2 - 6x + y^2 - 2y - 1 = 0$

Q15 Normanhurst Boys 2021 Trial Q1 · 1 mark

The equation of the semicircle illustrated below is given by



(A) $y = \sqrt{9 - x^2}$

(B) $y = -\sqrt{9 - x^2}$

(C) $y = \sqrt{3 - x^2}$

(D) $y = -\sqrt{3 - x^2}$

Q16 Sydney Girls 2021 Prelim Q3(c)(i) · 1 mark

Sketch the following, showing all key features:

$$y = -\sqrt{25 - x^2}.$$

Q17 Hornsby Girls 2022 Prelim Q17(a) · 1 mark

Consider the semicircle defined by the function $f(x) = \sqrt{8 - x^2}$.
Sketch the graph of $y = f(x)$.

Q18 Riverview 2021 Trial Q2(c)(i) · 2 marks

Draw the graph of $y = -\sqrt{4 - x^2}$ and shade the area bounded by the function and the x-axis where $x \leq 0$.

Q19 Killara 2022 Prelim Q6 · **1 mark**

The graph $y = -\sqrt{2 - x^2}$ can be described as

(A) One-to-one

(B) One-to-many

(C) Many-to-one

(D) Many-to-many

Q20 Presbyterian 2022 Prelim Q29 · **1 mark**

A semicircle has domain $[-1, 1]$ and range $[-1, 0]$. What is the equation of the semicircle?

4. Equation or parameters of a circle/semicircle from points or conditions

Q21 Hurlstone 2023 Prelim Q11(e) · **2 marks**

Find the equation of the circle with centre $A(1, 0)$ that passes through the point $B(4, 1)$.

Q22 Newington 2024 Trial Q30(a) · **1 mark**

The ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$ is shown. Show that for points in the top half of the ellipse, $y = \sqrt{9 - \frac{9}{4}x^2}$.

Diagram to be inserted:
`adv-working-with-functions-d8-q22.png`

Q23 Gosford 2024 Trial Q23 · **3 marks**

Find two possible equations of a semicircle with range $[3, 5]$, given that it is an even function.

Finding equations and problems

5. Tangency: find the parameter so an axis is tangent

Q24 Gosford 2020 Trial Q2 · **1 mark**

What is the value of c for which the circle $(x-3)^2+(y-2)^2=c$ touches the x-axis?

(A) 2

(B) 3

(C) 4

(D) 9

Q25 Knox 2022 Trial Q3 · **1 mark**

A circle has the equation $(x+2)^2+(y+3)^2=d$. What is the value of d such that the x-axis is a tangent to the circle?

(A) 2

(B) 3

(C) 4

(D) 9

Q26 St George Girls 2022 Trial Q2 · **1 mark**

A circle has the equation $(x+2)^2+(y+3)^2=r^2$. What is the value of r^2 such that the x-axis is a tangent to the circle?

(A) 2

(B) 3

(C) 4

(D) 9

Q27 Normanhurst Boys 2020 Trial Q3 · **1 mark**

What is the value of a for which the y-axis is tangent to the circle $(x-2)^2+(y-5)^2=a$?

(A) 2

(B) 4

(C) 5

(D) 25

Q28 Sydney Grammar 2023 Prelim Q8 · **1 mark**

For what values of r does the graph of $x^2+4x+y^2-2y+5=r^2$ intersect the x-axis but not the y-axis?

(A) $r<1$

(B) $1<r<2$

(C) $2<r<\sqrt{5}$

(D) $r>\sqrt{5}$

6. Coordinate-geometry problems on circles

Q29 Penrith 2024 Trial Q28 · **5 marks**

Carlisle is playing a game, in which he has to position a bomb anywhere on a number plane. When the bomb explodes it will kill anything within its circular blast zone.

(a) Find the position that Carlisle placed the bomb on the number plane and the radius of its circular blast zone, given its blast zone has an equation $x^2-20x+y^2+10y=-76$.

(b) Determine if an enemy located at the coordinates $(2,-4)$ will be killed when the bomb explodes. Justify your decision with a diagram and/or calculations.

Q30 Manly 2022 Trial Q30 · **4 marks**

Consider the circle $x^2-2x+y^2-4y-15=0$.

(a) Find the centre and radius of the circle.

(b) Determine the coordinates of the point on the circle for which the distance from the origin is a maximum.

Q31 Shore 2023 Prelim Q10 · **1 mark**

A point lies on the circle $x^2 + y^2 - 12x + 16y + 91 = 0$. What is the furthest distance, in units, the point could be from the origin?

(A) 9

(B) 11

(C) 13

(D) 14

Q32 North Sydney Girls 2025 Trial Q29(a) · **1 mark**

The diagram below shows a rectangle $PQRS$ drawn in a sector OAB of a circle with radius 6. Here $OR = x$, $QR = 2x$ and $RS = y$, with R and S on the radius OA and the vertex P on the arc. All units are in metres.

Diagram to be inserted:
`adv-working-with-functions-d8-q32.png`

Show that $(x + y)^2 = 36 - 4x^2$.

Q33 Hornsby Girls 2024 Trial Q26 · **4 marks**

The circle $x^2 + ax + y^2 + by + c = 0$, which has a radius of 3 units, is shifted to the right by 1 unit. After the shifting, the circle has its centre at $(3, -4)$. Find the values of a, b and c.

Q34 Sydney Boys 2022 Trial Q29(b) · **3 marks**

The line $2x - y + 5 = 0$ intersects the circle $x^2 + y^2 - 6x - 2y - 30 = 0$ at the points $P(-3, -1)$ and $Q(1, 7)$. The diagram below shows this circle together with a second congruent circle that also passes through P and Q.

Diagram to be inserted:
`adv-working-with-functions-d8-q34.png`

By considering the properties of rhombi, or otherwise, find the equation of the second circle.