

Sequences, functions and graphs – supported focus
4MA1 supported native-lesson focus only; qualification gaps remain

1. Supported teaching and tier boundary

Supported teaching and tier boundary

4MA1: Sequences, functions and graphs. Version: Issue 2, November 2017; first assessment June 2018; linear Mathematics A.

2. Supported teaching and tier boundary

Supported teaching and tier boundary

Foundation teaching and Higher additions are labelled below. This reference packages the existing native-lesson crosswalk. It does not certify unreviewed specification rows or a whole qualification. Original diagnostics are separate and are not reproduced.

3. Arithmetic sequences and nth terms · Foundation

Arithmetic sequences and nth terms · Foundation

Find a constant difference for an arithmetic sequence. Its n th term is $a+(n-1)d$. A term-to-term rule describes how to reach the next term; a position-to-term rule gives a term directly.

4. Arithmetic sequences and nth terms · Foundation

Arithmetic sequences and nth terms · Foundation

$$u_n = a + (n - 1)d$$

5. Arithmetic sequences and nth terms · Foundation

Arithmetic sequences and nth terms · Foundation

For 5, 8, 11, 14, ... the common difference is 3. The n th term is $5 + 3(n-1) = 3n + 2$. At $n=8$, $u_8=26$. To find the position of 62, solve $3n+2=62$, giving $n=20$.

6. Arithmetic sequences and n th terms · Foundation

Arithmetic sequences and n th terms · Foundation

The first term has index 1, so the exponent is $n-1$. A sequence is a list; a series is a sum. A geometric sequence can alternate in sign and still converge.

7. Arithmetic sequences and n th terms · Foundation

Arithmetic sequences and n th terms · Foundation

Generate several terms and check a proposed n th-term rule. Infinite geometric series and advanced sum formulae are excluded from this Foundation/Core lesson.

8. Arithmetic sequences and finite sums · Higher

Arithmetic sequences and finite sums · Higher

For an arithmetic sequence, $u_n = a + (n-1)d$. Pairing the first and last terms gives equal pair sums $a + u_n$. Therefore the first n terms have sum

$S_n = n(a + u_n)/2 = n[2a + (n-1)d]/2$. A sequence lists terms; a series adds them. State the first index before using a formula.

9. Arithmetic sequences and finite sums · Higher

Arithmetic sequences and finite sums · Higher

$$u_n = a + (n - 1)d, \quad S_n = \frac{n}{2} [2a + (n - 1)d]$$

10. Arithmetic sequences and finite sums · Higher

Arithmetic sequences and finite sums · Higher

For $a=5, d=3, n=8$, $u_8=5+7\times 3=26$ and $S_8=8(5+26)/2=124$. If the second term is 7 and the fifth is 19, then $3d=19-7=12$, so $d=4$ and $a=7-4=3$. The first four terms 3, 7, 11, 15 sum to 36, also $4(3+15)/2=36$. The sum formula depends on a constant difference.

11. Arithmetic sequences and finite sums · Higher

Arithmetic sequences and finite sums · Higher

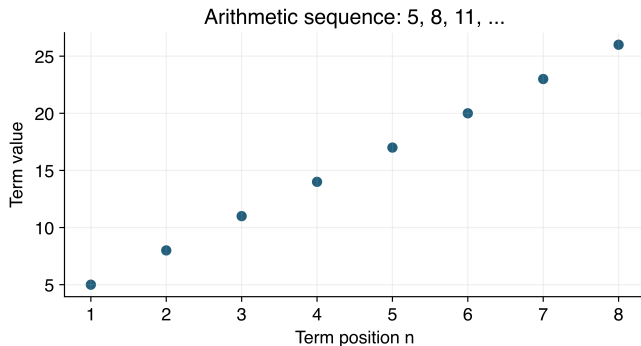
A term is not a sum. The first term is indexed by 1 in these formulae. An arithmetic sum requires a constant difference; increasing terms alone do not establish this.

12. Arithmetic sequences and finite sums · Higher

Arithmetic sequences and finite sums · Higher

4MA1 Higher 3.1 A–C covers common difference, the arithmetic n th term and the sum of the first n arithmetic terms. Geometric finite/infinite sum formulae are excluded from this supported focus lesson.

Figure 13: Arithmetic sequences and finite



Check the labelled values and conditions.

14. Straight lines and gradients · Foundation

Straight lines and gradients · Foundation

Gradient is change in y divided by change in x . A straight line has $y=mx+c$, where c is its y -intercept. Parallel lines have equal gradients.

15. Straight lines and gradients · Foundation

Straight lines and gradients · Foundation

$$y = mx + c$$

16. Straight lines and gradients · Foundation

Straight lines and gradients · Foundation

Through (2,5) with gradient 3, substitute to get $5=3\times 2+c$, so $c=-1$ and $y=3x-1$.
Points (1,2) and (4,8) give gradient $(8-2)/(4-1)=2$.

17. Straight lines and gradients · Foundation

Straight lines and gradients · Foundation

A vertical line has no finite gradient; do not force it into $y=mx+c$. Read the signs of a circle's centre carefully. The radius to a tangent is perpendicular to the tangent.

18. Straight lines and gradients · Foundation

Straight lines and gradients · Foundation

Plot a straight line using two checked points and label its intercept.

Perpendicular-gradient formulae and circle equations are not part of this Foundation/Core lesson.

19. Coordinate geometry and tangents · Higher

Coordinate geometry and tangents · Higher

A line through (x_1, y_1) with gradient m has $y - y_1 = m(x - x_1)$. Parallel lines have equal gradients. Finite perpendicular gradients multiply to -1 . A circle has $(x - a)^2 + (y - b)^2 = r^2$.

20. Coordinate geometry and tangents · Higher

Coordinate geometry and tangents · Higher

$$y - y_1 = m(x - x_1), \quad (x - a)^2 + (y - b)^2 = r^2$$

21. Coordinate geometry and tangents · Higher

Coordinate geometry and tangents · Higher

Through $(2,5)$ with gradient 3, $y-5=3(x-2)$, so $y=3x-1$. A perpendicular through the same point has $y-5=-(x-2)/3$. The circle $(x-2)^2+(y+1)^2=25$ has centre $(2,-1)$ and radius 5.

22. Coordinate geometry and tangents · Higher

Coordinate geometry and tangents · Higher

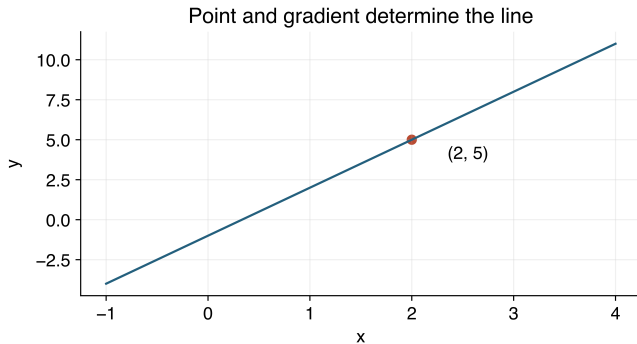
A vertical line has no finite gradient; do not force it into $y=mx+c$. Read the signs of a circle's centre carefully. The radius to a tangent is perpendicular to the tangent.

23. Coordinate geometry and tangents · Higher

Coordinate geometry and tangents · Higher

Before solving a line-circle intersection, predict whether there are zero, one or two intersections. Substitution produces a quadratic whose discriminant checks the prediction.

Figure 24: Coordinate geometry and tangents .



Check the labelled values and conditions.

25. Domains, inverses and composition · Higher

Domains, inverses and composition · Higher

State the domain and range. For an inverse, first ensure the function is one-to-one on its domain. Composition fg means apply g first, then f ; the intermediate output must be an allowed input to f .

26. Domains, inverses and composition · Higher

Domains, inverses and composition · Higher

$$f(g(x)) = (f \circ g)(x), \quad f^{-1}(f(x)) = x$$

27. Domains, inverses and composition · Higher

Domains, inverses and composition · Higher

For $f(x)=\sqrt{(x-2)}$, $x\geq 2$ and the range is $y\geq 0$. From $y=\sqrt{(x-2)}$, $x=y^2+2$. Thus f inverse $(x)=x^2+2$ with $x\geq 0$. For $g(x)=x+3$, $fg(1)=f(4)=\sqrt{2}$.

28. Domains, inverses and composition · Higher

Domains, inverses and composition · Higher

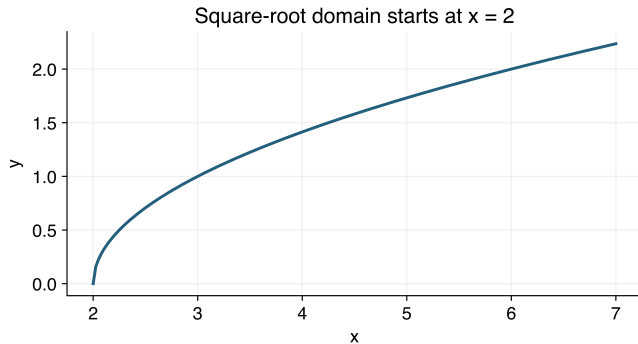
Squaring can introduce extraneous solutions. Restricting a parabola's domain is essential before claiming an inverse. A horizontal translation inside f has the opposite sign to the graph's movement.

29. Domains, inverses and composition · Higher

Domains, inverses and composition · Higher

Check $f(f^{-1}(x))=x$ on the inverse domain. Use a sketch to test whether a horizontal line meets the original graph more than once.

Figure 30: Domains, inverses and composition



Check the labelled values and conditions.

31. Derivatives and stationary points · Higher

Derivatives and stationary points · Higher

For a polynomial term ax^n with nonnegative integer n , the gradient term is anx^{n-1} . Add the differentiated terms. A stationary point has zero gradient.

32. Derivatives and stationary points · Higher

Derivatives and stationary points · Higher

$$\frac{d}{dx}(ax^n) = anx^{n-1}, \quad f'(x) = 0$$

33. Derivatives and stationary points · Higher

Derivatives and stationary points · Higher

For $y=x^3-3x$, $dy/dx=3x^2-3$. At $x=1$, the gradient is 0 and $y=-2$. The gradient $3x^2-3$ changes from negative to positive at $x=1$, so this is a local minimum. At $x=-1$, $y=2$ and the gradient changes from positive to negative, giving a local maximum. Use gradient signs and the graph shape, within this specification.

34. Derivatives and stationary points · Higher

Derivatives and stationary points · Higher

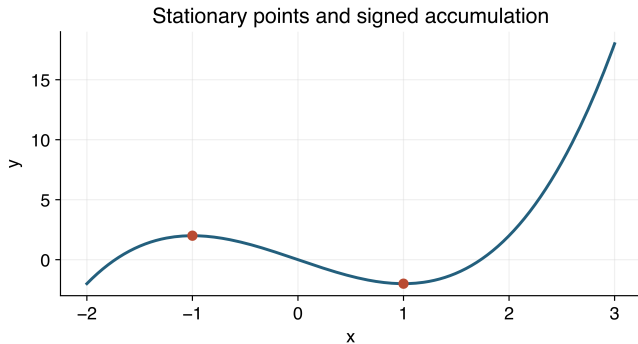
A zero derivative does not always mean a maximum or minimum: $y=x^3$ is stationary at 0 but continues increasing. An endpoint can also produce an extreme value on a restricted domain.

35. Derivatives and stationary points · Higher

Derivatives and stationary points · Higher

This advanced-tier IGCSE lesson is limited to polynomial differentiation, tangent gradients and stationary points. Chain, product, quotient and implicit differentiation are excluded.

Figure 36: Derivatives and stationary points



Check the labelled values and conditions.

37. Remaining qualification limits

Remaining qualification limits

Official question-bank boundaries, scheme alignment and all objective-level teaching coverage require the recorded review; no practice registry promotion.

38. Remaining qualification limits

Remaining qualification limits

The authored diagnostic assessments are not full-length qualification mocks.

39. Remaining qualification limits

Remaining qualification limits

Only the mapped native skills are supplied here. Objective rows marked formula-review-required are not promoted to complete coverage by these print companions.

40. Terms

Terms

common difference .

41. Terms

Terms

gradient .

42. Terms

Terms	
domain	.

43. Terms

Terms

derivative .

Check yourself

Reconstruct the method without looking back

Decide whether this claim is true. Give a concrete calculation or counterexample: The first term of a sequence always has index zero.