

Sequences, functions and graphs – supported focus

Pearson Edexcel · International GCSE · Mathematics A

Supported teaching and tier boundary

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

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.

■ Arithmetic sequences and nth terms · Foundation

Find a constant difference for an arithmetic sequence. Its nth 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.

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

For 5,8,11,14,... the common difference is 3. The nth 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 $n=20$.

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.

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

■ 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.

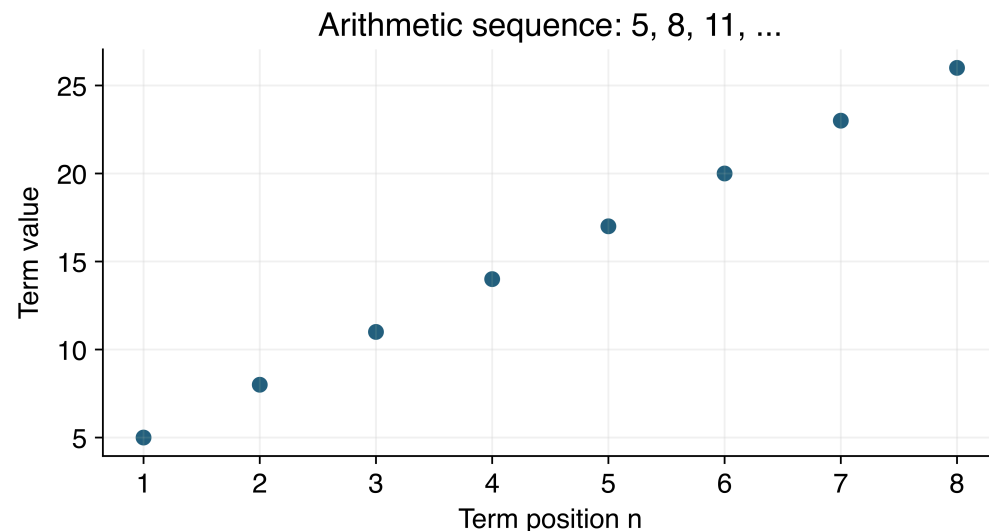
$$u_n = a + (n - 1)d, \quad S_n = \frac{n}{2} [2a + (n - 1)d]$$

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.

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.

4MA1 Higher 3.1 A–C covers common difference, the arithmetic nth term and the sum

of the first n arithmetic terms. Geometric finite/infinite sum formulae are excluded from this supported focus lesson.



Original native-lesson illustration; labels belong to its worked example.

■ 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.

$$y = mx + c$$

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 $(8-2)/(4-1)=2$.

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.

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.

■ 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 $(x-a)^2+(y-b)^2=r^2$.

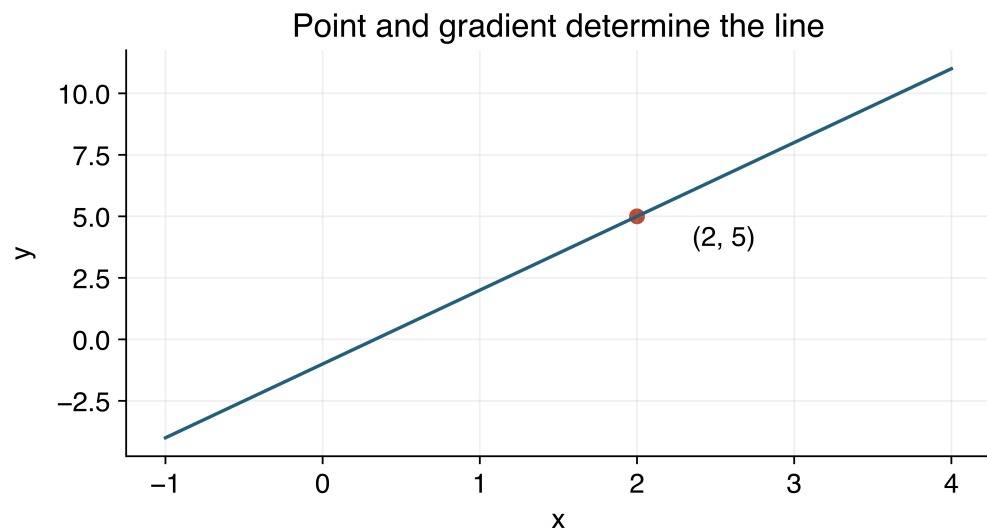
$$y - y_1 = m(x - x_1), \quad (x - a)^2 + (y - b)^2 = r^2$$

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.

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.

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



Original native-lesson illustration; labels belong to its worked example.

■ Domains, inverses and composition · Higher

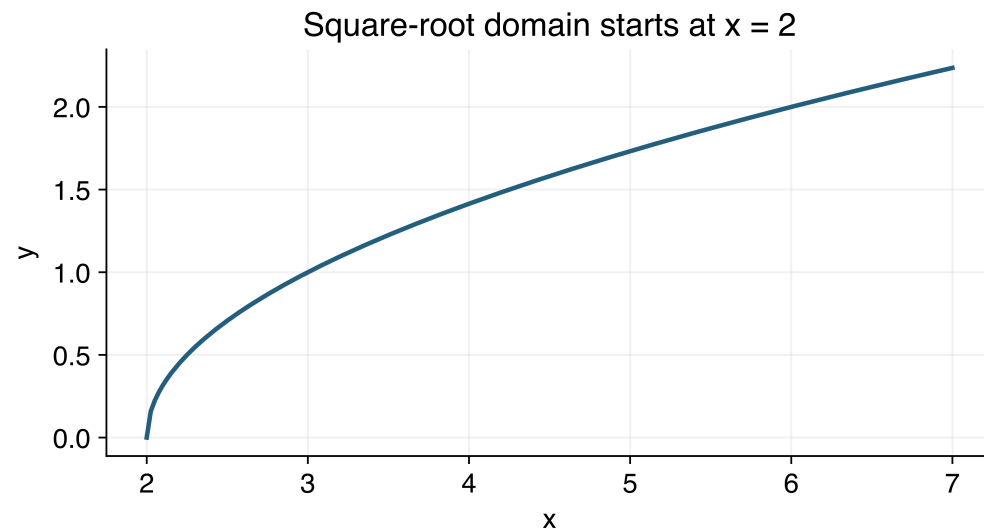
State the domain and range. For an inverse, first ensure the function is one-to-one on its domain. Composition fg means apply g first, then f ; the intermediate output must be an allowed input to f .

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

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 $g(x)=x+3$, $fg(1)=f(4)=\sqrt{2}$.

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.

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



Original native-lesson illustration; labels belong to its worked example.

■ Derivatives and stationary points · Higher

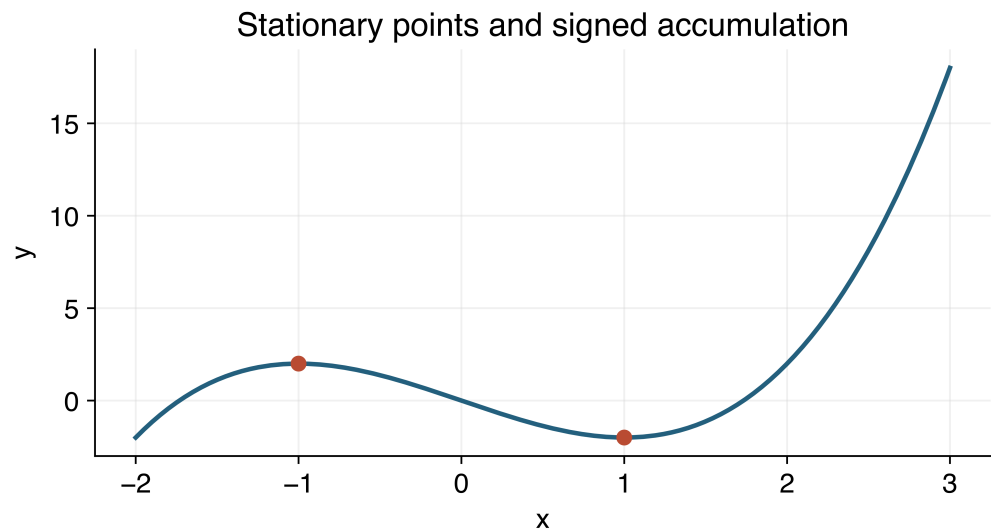
For a polynomial term ax^n with nonnegative integer n , the gradient term is anx^{n-1} . Add the differentiated terms. A stationary point has zero gradient.

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

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.

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.

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



Original native-lesson illustration; labels belong to its worked example.

Remaining qualification limits

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

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

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

Terms

- common difference .
- gradient .
- domain .
- derivative .