

2.4.1 Lines

Name: _____ Class: _____ Date: _____

KEY WORDS gradient

<!-- Session 2 native-skill companion -->

Objective

Practise lines within the labelled native lessons. Public original tasks; locally authored answer guidance.

1 Key knowledge and worked examples

■ 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

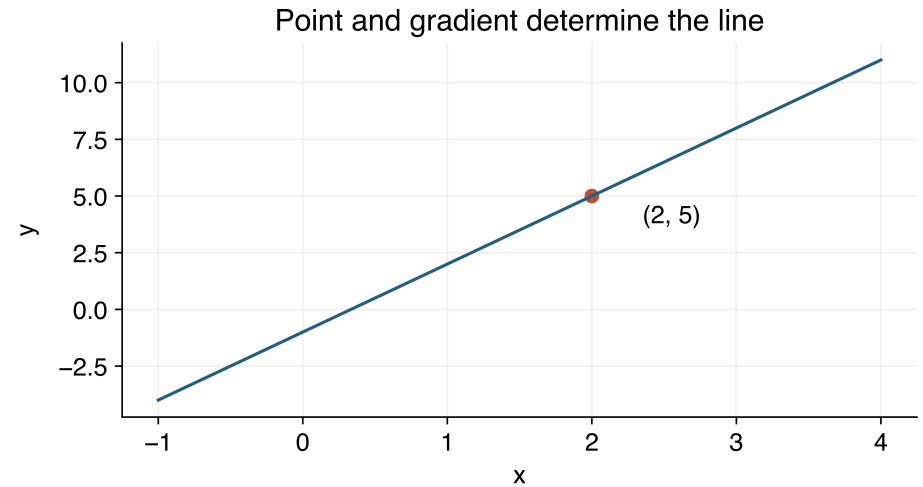
A line through (x_1, y_1) with gradient m has $y-y_1=m(x-x_1)$. Parallel lines have equal gradients. Finite perpendicular gradients multiply to -1. A circle has $(x-a)^2+(y-b)^2=r^2$.

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

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.

2 Practice

2.1 (Foundation) Find the gradient through (1,2) and (4,8).

2.2 (Foundation) Find the y-intercept of $y-5=3(x-2)$.

2.3 (Foundation) For $y=3x-1$, find y when $x=5$.

2.4 (Higher) Find the radius of $(x-2)^2+(y+1)^2=25$.

3 Exam-style questions

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: Perpendicular nonvertical lines always have equal gradients.

Solutions

2.1 Gradient= $(8-2)/(4-1)=6/3=2$.

2.2 Expand $y-5=3x-6$, so $y=3x-1$; the intercept is -1 .

2.3 Substitute $x=5$ into $y=3x-1$: $y=15-1=14$.

2.4 The radius is the positive square root of 25 , namely 5 .

3.1 False. $y=2x$ and $y=-x/2$ have gradients 2 and $-1/2$; their product is -1 . Equal gradients describe parallel distinct lines.

Local review guidance: show the chosen method; give the checked result; explain the condition or failed shortcut. This is authored classroom guidance.