

Parallel and Perpendicular

Introduction

Draw perpendicular lines on squared paper. Calculate the gradient of each line.

Encourage students to form a generalisation for a connection between the gradients of perpendicular lines.

Activity One

Ask students to answer open ended questions such as:

- What is the equation of a line that is perpendicular to a line with a gradient of $\frac{1}{2}$?
- What is the equation of a line that is perpendicular to a line with a gradient of -7 ?
- Give an example of the equation of a line that is perpendicular to the line
 - a) $y = 5x - 3$
 - b) $3y = 4 - 7x$
 - c) $3x + 2y = 5$
- Give the equations of any two lines that are perpendicular.

Activity Two: Instructions

There follows a matching activity that concentrates on parallel and perpendicular lines.

Cut out all the equations on the sheet. Ask students to use the equations to complete the following sentences using two of the equations. Students should also provide an explanation. The process is repeated until students have used all the cards.

..... is parallel to because ...

or

..... is perpendicular to because ...

Note: there are two cards containing each equation in case students want to use the same one for a parallel and a perpendicular example. Students could make up their own equations where appropriate.

Activity Two

$y = 4x + 1$	$2y = 8x - 3$	$y = 3x + 7$
$3y + x = 3$	$3y + x + 1 = 0$	$y = 3x - 7$
$2y = 6x + 3$	$3y = 6x - 1$	$4y = x + 4$
$4y + x = 4$	$y + 4x = 3$	$4x + y = 7$
$y = 6x + 1$	$4y + x = 1$	$y = 8x + 1$
$y = 4x + 1$	$2y = 8x - 3$	$y = 3x + 7$
$3y + x = 3$	$3y + x + 1 = 0$	$y = 3x - 7$
$2y = 6x + 3$	$3y = 6x - 1$	$4y = x + 4$
$4y + x = 4$	$y + 4x = 3$	$4x + y = 7$
$y = 6x + 1$	$4y + x = 1$	$y = 8x + 1$

Activity Three: Instructions

Activity three does not involve writing - just discussion. It could be used as a plenary activity.

Students cut out all the linear functions, then match the properties with those on the grid. Some functions fit more than one property and some properties require more than two functions. There is not a unique solution and students may have some functions left at the end. Students could devise properties to associate with those functions left over.

Students can compare and discuss their solutions.

Activity Three

$y = 4x + 8$	$2y = 8x - 3$
$3y + x = 3$	$3y + x + 1 = 0$
$2y = 6x + 3$	$3y = 6x - 1$
$4y + x = 2$	$y + 4x = 3$
$y = 6x + 1$	$4y + x = 1$
$y = 3x + 6$	$4y = x + 4$
$y = 3x - 6$	$4x + y = 4$
$y = 2x + 4$	$y = 2 - 2x$
$2y = x - 12$	$3x + y = 1$

These graphs have the same y - intercept.	These graphs are parallel.	Both these graphs pass through the point $(2, -5)$.
This graph is perpendicular to $y + 2x = 5$.	This graph is parallel to $6y + 2x = 1$.	This graph has the same y - intercept as $2y = 3x + 1$.
These graphs have the same x - intercept.	These graphs are perpendicular.	These graphs are not parallel.

Activity Four: Instructions

Activity Four takes longer than activity three and requires students to match each property to a description of a graph. Students cut out the four linear functions and stick them in the 4 corners of a large piece of paper. When they find an equation to match a property students stick it down and add as much justification as they can for their decision.

An extension exercise could require students to sketch each graph.

Activity Four

$$2y + 6x = 7$$

$$y = 6 - 2x$$

$$3y = x + 21$$

$$2y + 3x = 6$$

This graph crosses
the y -axis at $(0, 7)$
because

This graph crosses
the y -axis at $(0, 6)$
because

This graph crosses
the x -axis at $(2, 0)$
because

This graph crosses
the x -axis at $(3, 0)$
because

This graph has
gradient -3
because

This graph has
gradient $\frac{1}{3}$ because

This graph is parallel to $y + 2x = 1$ because	This graph is parallel to $6y = 2x + 5$ because
This graph is perpendicular to $2y = x + 1$ because	This graph is perpendicular to $3y = 2x - 5$ because
This graph passes through the point $(10, -12)$ because	This graph passes through the point $(3, 8)$ because
This graph does not pass through the point $(1, 4)$ because	This graph does not pass through the point $(5, 2)$ because