

Student Name: _____	Grade: _____
Date: _____	Score: _____

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1 Year 9 Term 4 Week 1 Homework

1.1 The Linear Function

1.1.1 Gradient of a line

The gradient or slope of a line is a measurement of how steep it is. The gradient of the line is usually denoted by the small letter 'm' and is define as:

$$\text{Gradient}(m) = \frac{\text{vertical rise}}{\text{horizontal run}}$$

If A has coordinates (x_1, y_1) and B has coordinates (x_2, y_2) then the gradient (m) of the line joining AB can be calculated using the formula given below:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Example 1.1.1 Find the gradient of the straight line passing through the following points:

1. $A(1, 3)$ and $B(4, 7)$

Solution: Let (x_1, y_1) be $(1, 3)$ and (x_2, y_2) be $(4, 7)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 3}{4 - 1} = \frac{4}{3}$$

\therefore The gradient is $1\frac{1}{3}$

2. $A(6, -2)$ and $B(2, -1)$

Solution: Let (x_1, y_1) be $(6, -2)$ and (x_2, y_2) be $(2, -1)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - (-2)}{2 - 6} = \frac{1}{-4}$$

\therefore The gradient is $-\frac{1}{4}$

Exercise 1.1.1

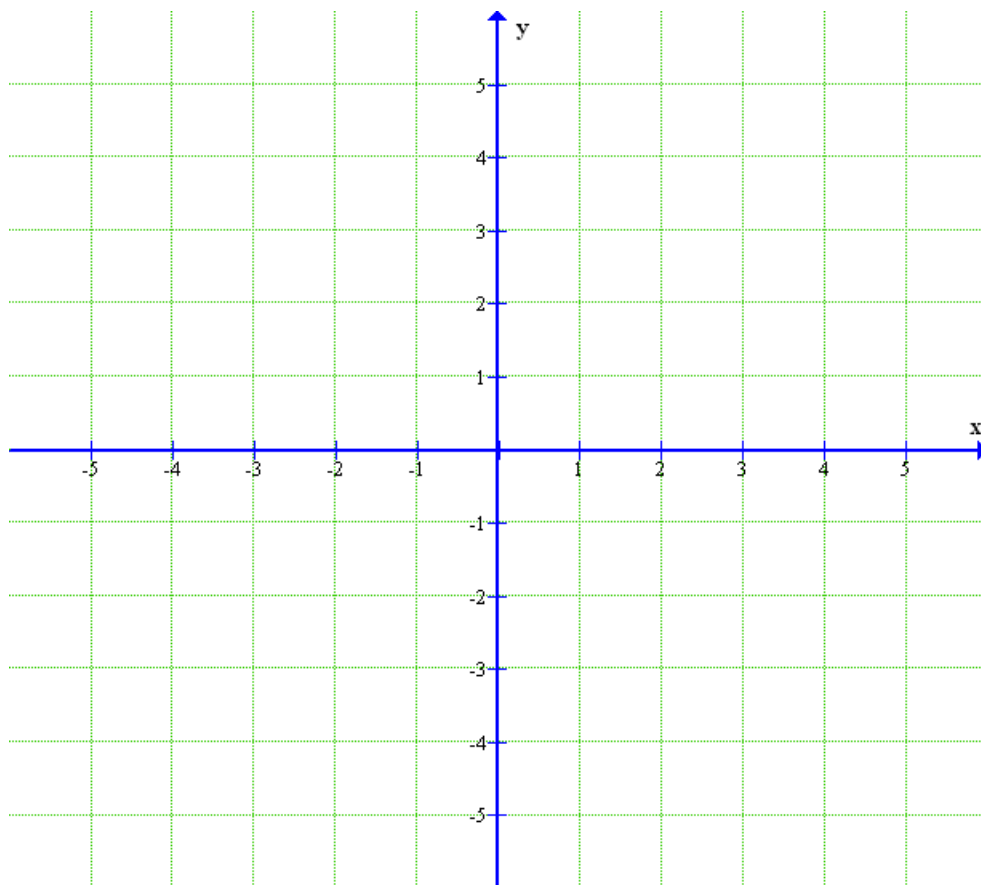
Find the gradient of the straight line passing through the following points: $A(-1, 3)$ and $B(4, -7)$.

1.1.2 Special type of line graphs

- If a line is increasing from left to right, then it has a positive gradient.
- If a line is decreasing from left to right, then it has a negative gradient.
- The gradient of a horizontal line is 0.
- The gradient of a vertical line is not defined.
- The gradient of a line that inclined to the x-axis at an angle of 45° is 1.

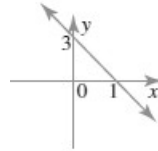
Exercise 1.1.2 Draw each of the following lines listed in the table. State whether the gradient of each line is positive, negative, zero or undefined.

$y = 3$	$x = 2$	$y = x$	$y = -3x$
$y = -4$	$x = -5$	$y = -x$	$y = 3x$

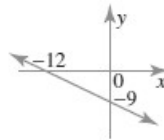


Exercise 1.1.3 Find the gradient of each line, hence state whether the gradient of each line is positive, negative, zero or undefined.

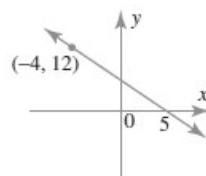
1 $m_1 =$ _____



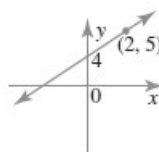
2 $m_2 =$ _____



3 $m_3 =$ _____



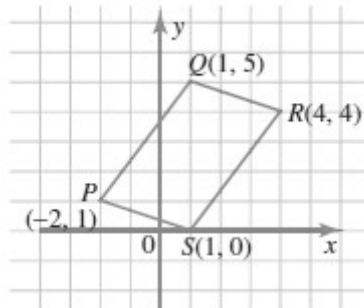
4 $m_4 =$ _____



1.1.3 Parallel lines

If two lines of gradient m_1 and m_2 are equal, these two lines must be parallel as they have the same slope.

Exercise 1.1.4

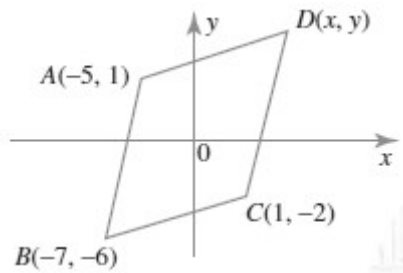


1. Find the gradient of PQ and SR . Is $PQ \parallel SR$?

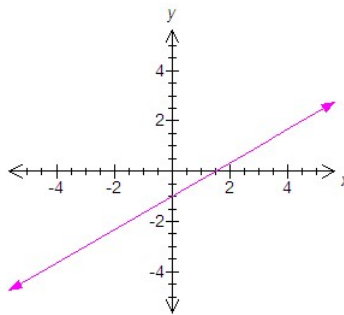
2. Find the gradient of QR and PS . Is $QR \parallel PS$?

3. What type of quadrilateral is $PQRS$? Why?

Exercise 1.1.5 Use the fact that parallel lines have the same gradient to find the co-ordinates of **D**, the fourth vertex of the parallelogram **ABCD**.



Exercise 1.1.6 Find the equation of the line which is perpendicular to $y = \frac{2}{3}x - 1$ and has a y-intercept of 5.



1.1.4 Perpendicular lines

If two lines of gradient m_1 and m_2 are perpendicular, then the product of their respective gradient must equal -1 .

Exercise 1.1.7 Which of the following lines are perpendicular to $y = -3x + 2$:

1. $3y - x + 3 = 0$ (Yes / No) _____

2. $3x + y = 2$ (Yes / No) _____

3. $6y - 2x + 4 = 0$ (Yes / No) _____

4. $3x - 3y = -3$ (Yes / No) _____

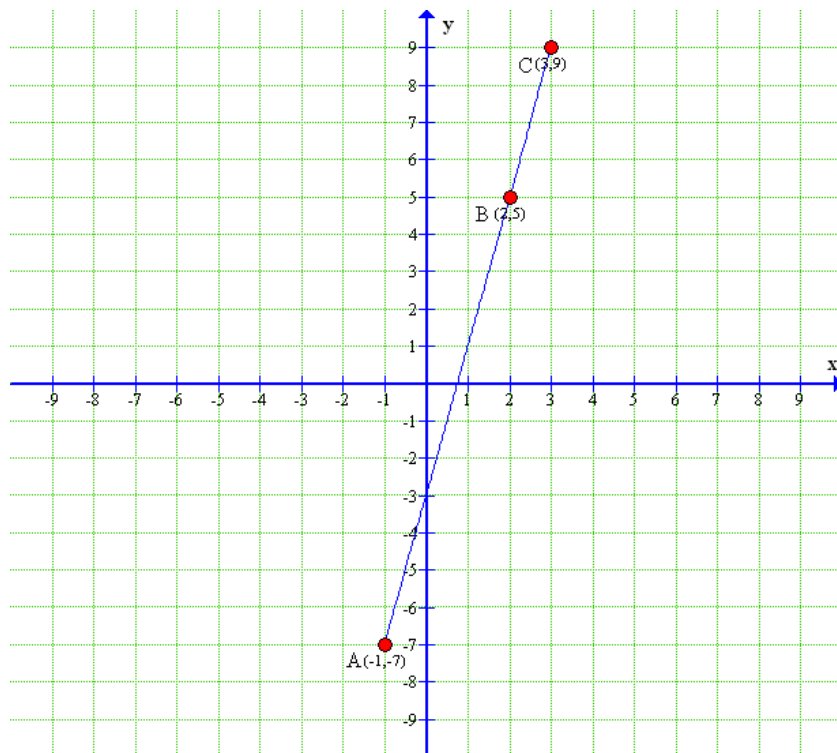
1.1.5 Collinear Points and Concurrent Lines

Three or more points are said to be **collinear** if they lie on a straight line. To determine whether or not three points are collinear, follow the steps below:

- Find the gradient m_1 between the first and the second point.
- Find the gradient m_2 between the second and the third point.
- If two gradients are equal then the 3 points are collinear.

Example 1.1.2 Determine whether or not the point $A(-1, -7)$, $B(2, 5)$ and $C(3, 9)$ are collinear.

Solution: Draw a diagram as shown below

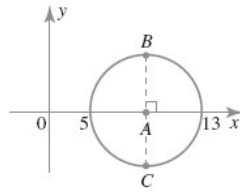


$$\begin{aligned}
 \text{Gradient of AB} = m_1 &= \frac{y_2 - y_1}{x_2 - x_1} & \text{Gradient of BC} = m_2 &= \frac{y_2 - y_1}{x_2 - x_1} \\
 &= \frac{5 - (-7)}{2 - (-1)} & &= \frac{9 - 5}{3 - 2} \\
 &= 4 & &= 4
 \end{aligned}$$

Since $m_1 = m_2$, the three points are collinear.

1.2 Miscellaneous Exercise

Exercise 1.2.1 The circle shown below has centre A and the diameter BC is parallel to y -axis.



1. Find the co-ordinates of A , B and C .

2. Find the exact circumference of the circle by using $\pi = \frac{22}{7}$.

3. Find the exact area of the circle by using $\pi = \frac{22}{7}$.

Exercise 1.2.2 Find the distance between each pair points.

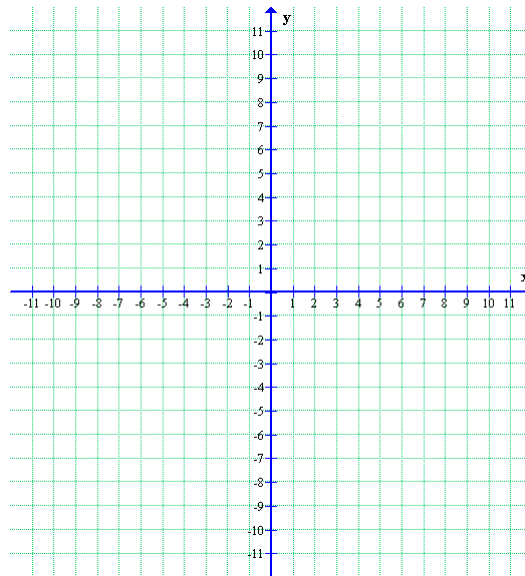
1. $A(-2, 3)$ and $B(4, 7)$

2. $C(-6, 0)$ and $D(0, 8)$

3. $E(-4, 3)$ and $F(4, -3)$

Exercise 1.2.3 The vertices of $\triangle ABC$ are $A(-2, 2)$, $B(10, -3)$ and $C(-2, -8)$.

1. Plot the points A , B and C on a number plane.



2. By inspection, what kind of triangle is ABC ?

3. Find the area of the $\triangle ABC$

Exercise 1.2.4 Which of the following points lie on the line $y = 2x - 7$?

1. $A(-6, 5)$

2. $B(-8, -23)$

3. $C(3\frac{1}{2}, 0)$
