

**Sangam SKM College – Nadi**  
**Lesson notes- Week 1**  
**Year 11**  
**Mathematics**

<b>Strand</b>	Coordinate Geometry
<b>Sub Strand</b>	Find distance between two points , Find the midpoint, Determine equation of a line
<b>Content learning outcome</b>	At the end of the lesson, students should be able to <ul style="list-style-type: none"> <li>identify the distance formula and calculate the distance between two points, use the formula and find the midpoint, determine the gradient from two given points, find equation of a line from y intercept and gradient.</li> </ul>

**Distance Formula**

To find the distance between any two points:

1. Use  $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
2. Label the ordered pairs.
3. Substitute the values into the formula.
4. Use order of operations to simplify.

**Examples:**

Find the distance between the two points,  $(4, 5)$        $(2, 6)$   
 $(x_1, y_1)$        $(x_2, y_2)$ .

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(2 - 4)^2 + (6 - 5)^2} = \sqrt{(-2)^2 + (1)^2} = \sqrt{5}$$

**Midpoint Formula**

To find the middle of a segment that connects two points.

1. Use  $mp = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$
2. Label the ordered pairs  $(x_1, y_1)$  and  $(x_2, y_2)$ .
3. Substitute the values into the formula.
4. Use **order of operations** to simplify.

**Examples:**

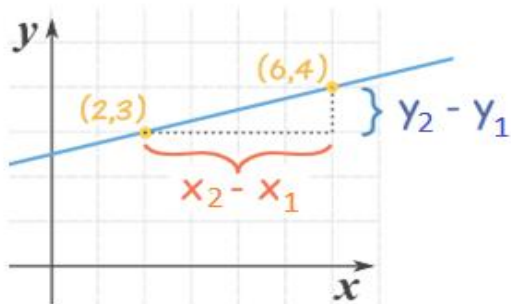
Find the midpoint of  $(-14, -4)$  &  $(1, 8)$

$(x_1, y_1)$        $(x_2, y_2)$ .

$$mp = \left(\frac{-14 + 1}{2}, \frac{-4 + 8}{2}\right) = (6.5, 2)$$

**Finding Slope (or Gradient) from 2 Points**

What is the slope (or gradient) of this line?



The formula is:

$$\text{Slope } m = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

**Example:**

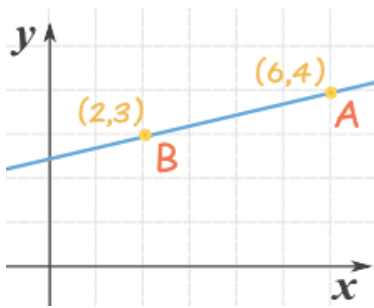
For the above line, the two points are (2, 3) and (6, 4).

$$(x_1, y_1) \quad (x_2, y_2).$$

$$\text{Slope } m = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 3}{6 - 2} = \frac{1}{4}$$

**Finding an Equation from 2 Points**

Now you know how to find the **slope**, let us look at finding a whole **equation**.



What is the equation of this line?

The easiest method is to start with the "point-slope" formula:

$$y - y_1 = m(x - x_1)$$

We can choose any point on the line as being point "1", so let us just use point (2,3):

$$y - 3 = m(x - 2)$$

Use the formula from above for the slope "m":

$$\text{Slope } m = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 3}{6 - 2} = \frac{1}{4}$$

And we have:

$$y - 3 = \frac{1}{4}(x - 2)$$

That is an acceptable answer, but we could simplify it further:

$$y - 3 = \frac{x}{4} - \frac{1}{2}$$

$$y - \cancel{3} + \cancel{3} = \frac{x}{4} - \frac{1}{2} + 3$$

$$y = \frac{x}{4} + \frac{5}{2}$$

**Exercise**

Year 11 Mathematics

**Ex 5.1** (page 117)

Q1, Q2, Q6, Q7, Q9

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Lesson Notes : Week 2

Year 11

Mathematics – Applied

**Strand 5:** Co-ordinate Geometry

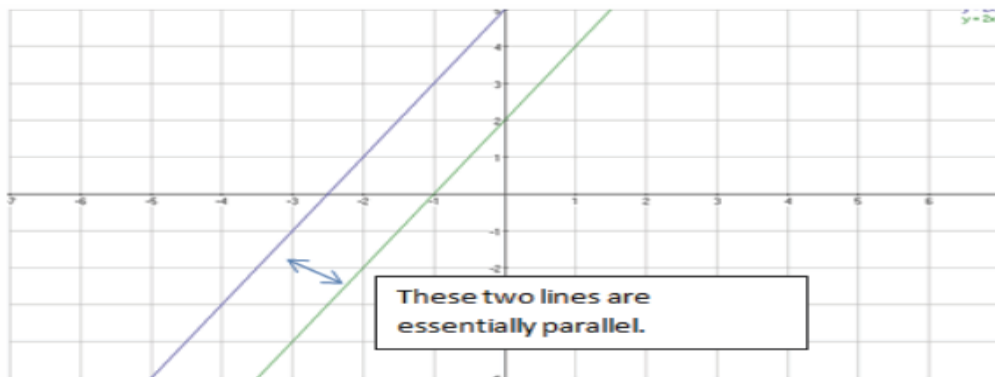
**Sub-strand:** Parallel Lines

**Content Learning Outcomes:**

- Determine gradient and equation of parallel lines

**Parallel Lines**

- **Parallel lines** are **lines** which are always the same distance apart and never meet.
- Parallel lines have the same gradient ( $m_1 = m_2$ ).
- General form of the equation:  $y = m_1x + c$  , where  $m_1$  is the gradient and  $c$  represents the y-intercept .
- Another method is using 2-point formula  $y - y_1 = m_1(x - x_1)$  where  $m_1$  is the gradient and  $(x_1, y_1)$  are the co – ordinates.
- Graphically:



**Example: 1**

What is the slope of a line parallel to  $2y = -10x - 8$ ?

Solution: make y the subject to find  $m_1$ .

$$2y = -10x - 8$$

$$y = \frac{-10x-8}{2}$$

$$y = -5x - 4$$

where  $m_1 = -5 \longrightarrow$  gradient of parallel line.

### **Example: 2**

What is the equation of a line that passes through the point  $(-3,2)$  and is parallel to  $4x = 2y + 12$ ?

#### **Solution**

**Step1:** Make  $y$  the subject to find the gradients  $m_1$  .

$$4x = 2y + 12$$

$$4x - 12 = 2y$$

$$\frac{4x - 12}{2} = y$$

$$m_1 = 2$$

**Step 2:** Use **2- point formula and  $m_1$**  to find equation of parallel line.

$$y - y_1 = m_2 (x - x_1)$$

$$y + 2 = 2(x - -3)$$

$$y + 2 = 2(x + 3)$$

$$y + 2 = 2x + 6 - 2$$

$$y = 2x + 4$$

Therefore the equation of parallel line is :  **$y = 2x + 4$**

### **Example: 3**

Find the equation of the line which is parallel to  $y = - 2x + 44$  and passes through the point  $(- 22, 0)$ .

**Step 1 :** Identify the information given.

$$m_1 = -2 \text{ and the given co-ordinates } (-22, 0)$$

**Step 2:** Use **2- point formula and  $m_1$**  to find equation of parallel line.

$$y - y_1 = m_2 (x - x_1)$$

$$y - 0 = -2(x - -22)$$

$$y = - 2(x + 22)$$

$$y = -2x - 44$$

$$y = -2x - 44$$

Therefore the equation of parallel line is:  **$y = -2x - 44$**

### **Activity**

1. What is the equation of a line that passes through the point  $(4,-5)$  and is parallel to  $3x + 2y = 12$ ?
2. What is the equation of a line that is parallel to  $y = -4$  and passes through the point  $(3, 7)$ ?
3. Write the equation of a line that is parallel to  $4x + 2y = -8$  and has the same  $y$ -intercept as  $-3y = -2x - 9$ ?

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Lesson Notes: Week 3

Year 11

Mathematics – Applied

**Strand 5:** Co-ordinate Geometry

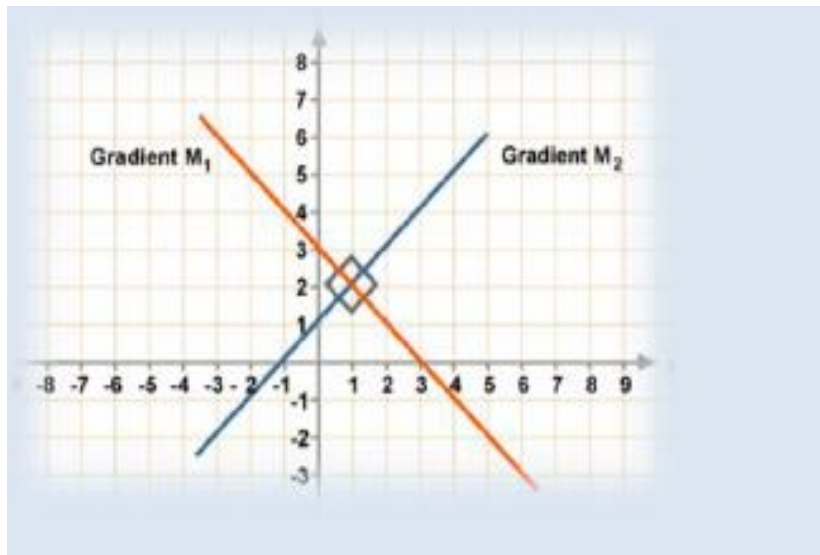
**Sub-strand:** Perpendicular Lines

**Content Learning Outcomes:**

- Determine gradient and equation of perpendicular lines

**Perpendicular Lines**

- Perpendicular simply means '**at right angle**'.
- A line is perpendicular to another if they meet at **90 degrees**.
- Graphically :



- Two lines are perpendicular if the **product of gradient is negative one** that is:

$$m_1 m_2 = -1$$

- After rearranging the formula  $m_2$  can be written as  $m_2 = \frac{-1}{m_1}$
- General form of the equation:  $y - y_1 = m_2 (x - x_1)$  where  $m_2$  is the gradient of perpendicular line and  $(x_1, y_1)$  are the co – ordinates.
- Slope is also known as gradient.

### Example: 1

What is the slope of a line perpendicular to  $3y = -12x - 9$ ?

Solution: make y the subject to find  $m_1$ .

$$3y = -12x - 9$$

$$y = \frac{-12x-9}{3}$$

$$y = -4x - 3$$

where  $m_1 = -4$   $\longrightarrow$  Parallel line gradient

$$m_2 = \frac{-1}{m_1} = \frac{-1}{-4} = \frac{1}{4} \longrightarrow \text{Perpendicular line gradient}$$

### Example: 2

What is the equation of a line that passes through the point  $(-2,3)$  and is perpendicular to  $3x = 2y + 10$ ?

#### **Solution**

**Step1:** Make y the subject to find the gradients  $m_1$  and  $m_2$ .

$$3x = 2y + 10$$

$$3x - 10 = 2y$$

$$\frac{3x - 10}{2} = y$$

$$m_1 = \frac{3}{2} \quad \text{and} \quad m_2 = \frac{-1}{m_1} = -1 \div \frac{3}{2} = \frac{-2}{3}$$

**Step 2:** Use **2- point formula** and  $m_2$  to find equation of perpendicular line.

$$y - y_1 = m_2 (x - x_1)$$

$$y - 3 = \frac{-2}{3} (x - -2)$$

$$y - 3 = \frac{-2}{3} (x + 2)$$

$$y - 3 = \frac{-2}{3} x - \frac{4}{3} + 3$$

Therefore the equation of perpendicular line is :  $y = \frac{-2}{3} x + \frac{5}{3}$

#### Activity

1. What is the slope of a line perpendicular to  $2y = -6x - 10$ ?
2. What is the equation of a line that passes through the point  $(-1,-2)$  and is perpendicular to  $-5x = 6y + 18$ ?
3. A line passes through a point  $(2, 5)$  and has a slope of  $-3$ . What is the equation of a line **perpendicular** to this line through  $(2, 5)$ ?