

## Determining the equation of a line

From a graph, when the scale on the x and y axes is the same

**Ex 3** Determine the equation of the line pictured on the graph shown below.

	<b>1</b>	Begin with the point-slope equation of a line	$y = mx + b$
	<b>2</b>	Identify your RATE OF CHANGE (slope). This is "m"	$m = -2$
	<b>3</b>	Identify your INITIAL VALUE (y-intercept). This is "b"	$b = 1$
	<b>4</b>	Put everything together	$y = -2x + 1$

### Practice 4 – Writing an Equation from a Graph

15. Determine the equation of each line shown below.

<p>a.</p>	<p>b.</p>	<p>c.</p>	<p>d.</p>
Equation: $y = \frac{1}{2}x$	Equation: $y = -\frac{2}{3}x - 1$	Equation: $y = -x + 1$	Equation: $y = \frac{7}{5}x - 3$
<p>e.</p>	<p>f.</p>	<p>g.</p>	<p>h.</p>
Equation: $y = -2x + 1$	Equation: $y = \frac{1}{2}x + 1$	Equation: $y = -x + 4$	Equation: $y = -x + 5$

## Determining the equation of a line

### From two points

You may be given your two points, or they may come from a table of values or a graph

Ex 4 Determine the equation of a line that goes through point A (3,4) and point B (-5,0)		
<b>1</b>	Use the two points and the slope formula to find the slope	$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 0}{3 - (-5)}$ $= \frac{4}{8}$ $= \frac{1}{2}$
<b>2</b>	Replace "m" with the slope in "y=mx + b"	$y = \frac{1}{2}x + b$
<b>3</b>	Pick one of your points and substitute it in for "x" and "y" to solve for "b"	$0 = \frac{1}{2}(-5) + b$ $0 = -2.5 + b$ $2.5 = b$
<b>4</b>	Take your "m" and "b", and put them into "y=mx + b" form	$y = \frac{1}{2}x + 2.5$

Ex 5 Nat hires a cleaning service. For 4 hours of cleaning, they charge \$112. For 6 hours of cleaning, they charge \$144. Determine the equation of a line that relates total cost to number of hours.		
<b>1</b>	Identify the DEPENDENT (y) and INDEPENDENT (x) variables. Define them	Let x be number of hours Let y be total cost
<b>2</b>	Interpret the information given as ordered pairs. Use the two points and the slope formula to find the slope	$(4, 112) \quad m = \frac{144 - 112}{6 - 4} = \frac{32}{2} = 16$ $(6, 144)$
<b>3</b>	Replace "m" with the slope in "y=mx + b"	$y = 16x + b$
<b>4</b>	Pick one of your points and substitute it in for "x" and "y" to solve for "b"	$112 = 16(4) + b$ $112 = 64 + b$ $48 = b$
<b>5</b>	Take your "m" and "b", and put them into "y=mx + b" form	$y = 16x + 48$

## Practice 5 – Writing an Equation from two points

16. For each of the following pairs of points, find the equation of the line that passes through them:

a. (1, -4) and (3, 2)  $y = 3x - 7$

b. (-5, 2) and (7, -1)  $y = -\frac{1}{4}x + \frac{3}{4}$

c. (-2, 5) and (3, -5)  $y = -2x + 1$

d. (1, -1) and (8, 1)  $y = \frac{2}{7}x - \frac{9}{7}$

e. (0, 5) and (45, -18)  $y = -\frac{23}{45}x + 5$

f. (278, 109) and (26, -210)  $y = 1.27x - 242.91$

g. (-2.7, -8.3) and (-4.9, 0)  $y = -3.77x - 18.49$

h. (95, -32) and (-23, 145)  $y = -\frac{3}{2}x + 110.5$

17. Determine the equation of the line represented by each table below

$y = -3x - 1$

x	y
-3	8
-2	5
-1	2
0	-1
1	-4
2	-7
3	-10

$y = 2x - 8$

x	y
0	-8
1	-6
2	-4
3	-2
4	0
5	2
6	4

$y = \frac{3}{2}x + 57$

x	y
10	72
20	87
30	102
40	117
50	132
60	147
70	162

$y = 0.069x + 1000$

x	y
0	1000
-500	965.5
-1000	931
-1500	896.5
-2000	862
-2500	827.5
-3000	793

18. Determine the equation of the line represented by each situation:

- a. Chris is draining water out of his pool. After 2h, he has 108 600L left. After 5h, he has 106 350L left. Write an equation relating the volume of water and time. When will the pool be empty?  $y = -750x + 110100$

The pool will be empty after 146.8 hours.

- b. Esfand works at a clothing store. He makes a flat salary, plus an hourly rate. He makes \$860 when he works a 20h week. When he works 45h, he makes \$1310. Write an equation relating total earnings to number of hours. Using your equation, determine how much he will make if he works a 40h week.  $y = 18x + 500$

He will make \$1220

- c. Dom is taking a road trip and keeping track of the kilometres travelled, as well as the amount of gas he's left with. After 120km, he has 35.4L of gas left. After 380km, he has 14.6L of gas left. Write an equation relating number of kilometres travelled to total gas in the tank. Using your equation determine how much gas he started with.  $y = -0.08x + 45$

He started with 45L.

- d. A plane is descending to land. After 5 minutes, it is at 15 000 feet. It hits the ground after 12.5 minutes.

Create an equation to model this situation. How high was the plane when it began its descent?  $y = -2000x + 25000$

It was 25 000 feet high.

- e. A company is tracking its sales over the years. The company began tracking its sales in 1995. By 2005, its sales were \$328 500. In 2012, its sales were \$243 600. Assuming a constant rate of decline, create an equation relating sales to years. What were the sales in 1995? When will the company go broke (\$0 in sales)?

$y = -12128.57x + 449785.71$  Sales were \$449 785.71 in 1995. They will go broke in 2032.

- f. Sierra is performing an experiment where she measures the temperature of a cup of water while it heats up. After 3 minutes, the temperature is 5°C. After 10 minutes, the temperature is 45°C. Create an equation relating time to temperature. What was the temperature of the water when the experiment began?

$y = 5.71x - 12.14$  It was -12.14°C

- g. Natalie is renting a limo for an event. For 2h of service, the limo company charges \$1499. For 6h of service, the limo company charges \$1947. Write an equation relating time to cost. How much will it cost to rent the limo for 5h?

$y = 112x + 1275$  It will cost \$1835.