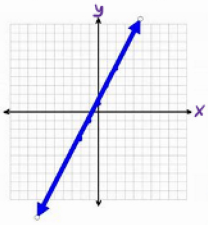
Graphing functions

30 November 2019 09:32

① Linear - Straight line

Graphing a linear function using a table

x	$y = 2x + 1$	Y
-2	$y=2(-2)+1$	-3
-1	$y=2(-1)+1$	-1
0	$y=2(0)+1$	1
1	$y=2(1)+1$	3
2	$y=2(2)+1$	5



Domain

$-2 \leq x \leq 2$

x= Domain
In put values

y= Range
Out put values.

Couple
(x, y)
(input, output)
Point

Recap on Patterns

Take output values y value

T_1

1, 3, 5

+2

First difference
is constant. Linear

$T_n = a + (n-1)d$
$a = +3$ First term
$d = 2$ common difference

Sub in to formula

$T_n = +3 + (n-1)2$
$= +3 + 2n - 2$
$T_n = 2n + 1$ $\Rightarrow$

The Intercept Method

Find where the line cuts the x and y axis.

① on the xaxis $y=0$

② On the yaxis $x=0$

Eg1 Graph the lines ① $y=5-x$ and ② $y=2x-4$ in the domain $0 \leq x \leq 4$ $\{0,1,2,3,4\}$ and find where the lines intersect

① $y = 5 - x$

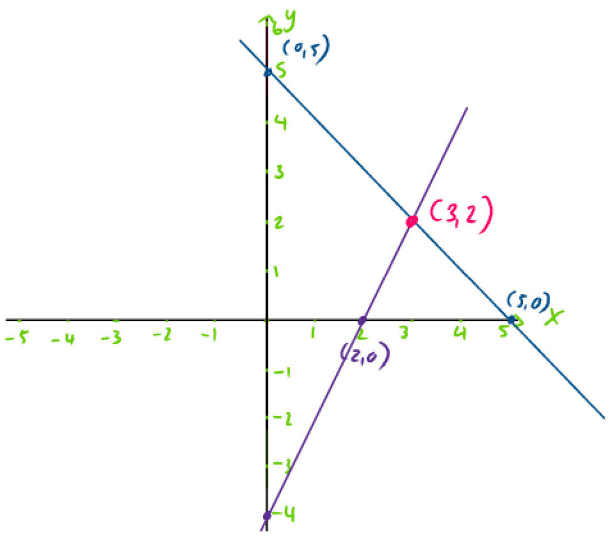
Xaxis
$y=0$
$0 = 5 - x$
$+x \quad x = 5 \quad +x$
$(5, 0)$

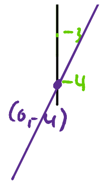
yaxis
$x=0$
$y = 5 - \cancel{0}$
$y = 5$
$(0, 5)$

② $y = 2x - 4$

Xaxis
$y=0$
$0 = 2x - \cancel{4}$
$+4 \quad 4 = 2x \quad +4$
$\div 2 \quad 2 = x \quad \div 2$
$(2, 0)$

y axis
$x=0$
$y = \cancel{2(0)} - 4$
$y = -4$
$(0, -4)$

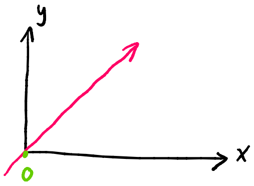




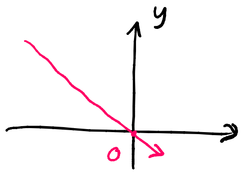
Directly Proportional Graphs

These graphs will be linear – A straight line and contain the origin (0,0)

Eg) 1



Positive slope
The line is rising from left to right



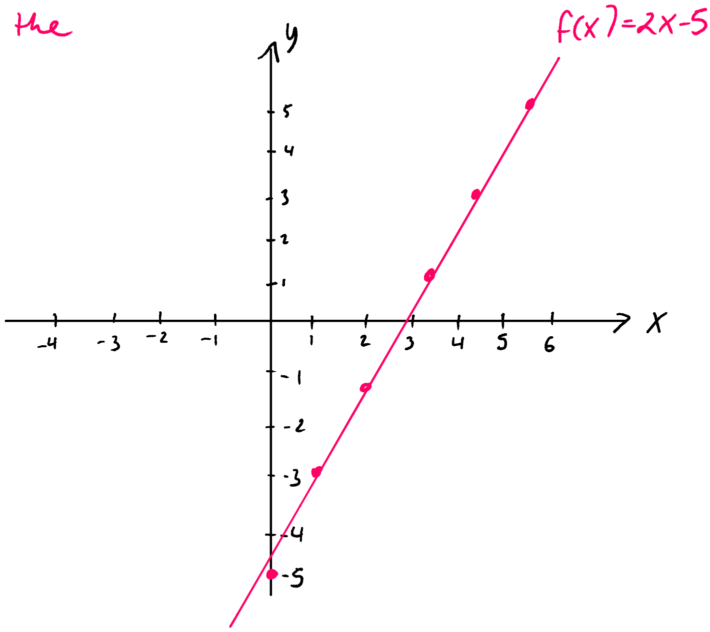
negative slope
The line is falling from left to right

Steps to use a calculator to graph functions

1) Calculator => [MODE] [3] Table
2) f(x) = Input given function   x = [ALPHA] [)] bracket
3) [=] to input function
4) Start? the first value in the domain [=]
5) End? The last value in the domain [=]
6) Step? 1 to go up in units of 1

Eg1) Graph the function $f(x) = 2x - 5$ in the domain $0 \le x \le 5$.

x	f(x) = y	couple (x, y)
0	-5	(0,-5)
1	-3	(1,-3)
2	-1	(2,-1)
3	1	(3,1)
4	3	(4,3)
5	5	(5,5)



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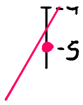

T&T3 17.1

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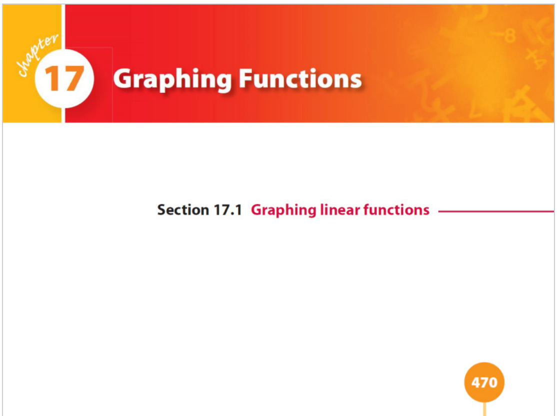
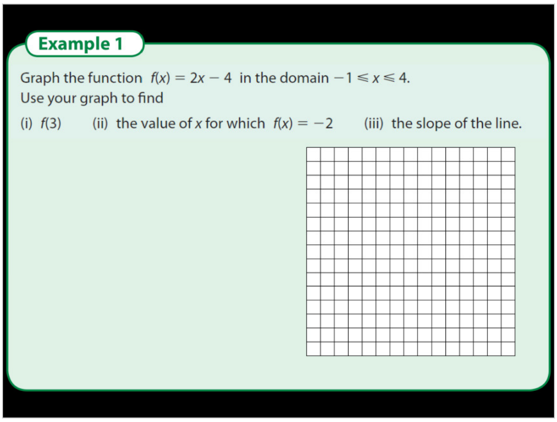




Exercise 17.1

1. Copy and complete the table on the right and use the table to draw a graph of the line $y = 2x - 3$ in the domain $-1 \leqslant x \leqslant 4$.

x	$2x - 3$	y
-1		
0		
1		
2		
3		
4		

Exercise 17.1

2. Draw the graph of $f(x) = 2x - 5$ in the domain $0 \leqslant x \leqslant 5$.

Exercise 17.1

3. Copy and complete the table on the right and hence draw a graph of the function $f(x) = 3x - 4$ in the domain $-1 \leqslant x \leqslant 3$.

x	$3x - 4$	y
-1		
0		
3		

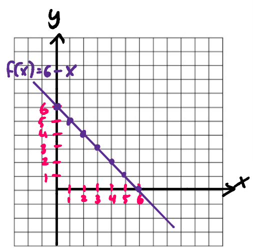
Exercise 17.1

$\{0, 1, 2, 3, 4, 5, 6\}$

4. Draw the graph of the function $f(x) = 6 - x$ in the domain $0 \leqslant x \leqslant 6$ by finding only three points on the line.

$6-(0)$

x	fx	Couple
0	6	(0, 6)
1	5	(1, 5)
2	4	(2, 4)
3	3	(3, 3)
4	2	(4, 2)
5	1	(5, 1)
6	0	(6, 0)



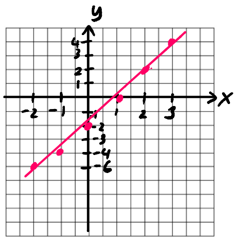
Exercise 17.1

−2, −1, 0, 1, 2, 3

5. Draw the graph of the function $f(x) = 2x - 2$ in the domain $-2 \leqslant x \leqslant 3$.

$2(-2)-2$

x	f(x)	Couple
−2	−6	(−2, −6
−1	−4	(−1, −4)
0	−2	(0, −2)
1	0	(1, 0)
2	2	(2, 2)
3	4	(3, 4)



Exercise 17.1

6. Drawn on the right is the graph of a function $y = f(x)$.

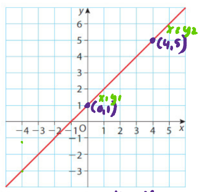
Use the graph to write down

(i) $f(3) = 4$ (ii) $f(0) = 1$ (iii) $f(-4) = -3$

(iv) the value of x when $f(x) = -2 \Rightarrow f(-3) = -2$

(v) The value of x when $f(x) = 6$. $f(5) = 6$

Use the grid to write down the slope of the line.
Is the function $y = f(x)$ increasing or decreasing?
Explain your answer.



Slope : $\frac{\text{Rise}}{\text{Run}} = \frac{2}{2} = 1$

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

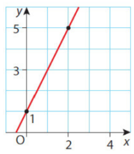
$\frac{5-1}{4-0} = \frac{4}{4} = 1$

Positive → Rising left to right

H/W pg 473/474 Q7 + 8

Exercise 17.1

7. Use the grid in the given diagram to write down the slope of the line.
Now express the equation of the line in the form $y = mx + c$.



Exercise 17.1

8. The given diagram shows the graphs of two lines, $f(x) = x + 1$ and $g(x) = 2x - 2$.

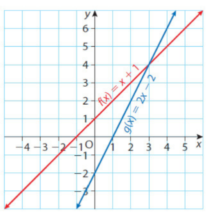
(i) Write down the point of intersection of the two lines.

(ii) What is the meaning of the equation $f(x) = g(x)$ in this situation?

(iii) Solve the equation $x + 1 = 2x - 2$.
Is there any connection between the value you found for x and the point of intersection of the two lines?

(iv) Is there another way of finding the point of intersection of two lines besides drawing their graphs?

(v) If $f(k)$ has the same value as $g(k)$, write down the value of k.



Exercise 17.1

9. On the same diagram, draw the lines $y = 5 - x$ and $y = 2x - 4$, in the domain $0 \leqslant x \leqslant 4$.
Use your graph to write down the point of intersection of the two lines.

Exercise 17.1

10. By finding the couples $(*, 0)$ and $(0, *)$, draw a graph of the line $y = 4 - 2x$.

Exercise 17.1

11. Use the intercept method to draw the graph of the line $3x + 2y = 6$.

Exercise 17.1

12. A car uses petrol at the rate of 1 litre per 10 km.
Copy and complete the table below to show the petrol consumption of the car over a journey of 50 km.

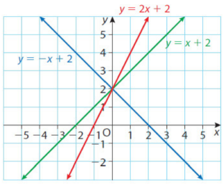
Distance	0	10	20	30	40	50
Petrol consumption	0					

(i) Draw the graph to show this information.
(ii) Is the graph directly proportional? Explain your answer.
(iii) By taking two (input, output) values, find the equation of the line.
(iv) Use the equation you have found to find the petrol consumption for a journey of 75 km.

Exercise 17.1

13. The lines $y = x + 2$, $y = -x + 2$ and $y = 2x + 2$ have been graphed on the same axes on the right.

(i) How are the lines similar?
(ii) How are the linear equations similar?
(iii) How are the lines different?
(iv) How are the linear equations different?
(v) Which function is decreasing?
(vi) Which function is increasing at the faster rate?



Exercise 17.1

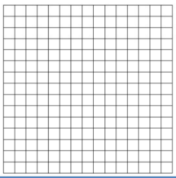
14. $f(x) = 4x - 3$ defines a function.
Make out a table of inputs and outputs for $f(x)$ from $x = -2$ to $x = 4$.
Are the first differences between the outputs constant?
Explain why the function is linear.

Exercise 17.1

15. Penguins survive in freezing climates.
The temperature T °C at a penguin colony, t hours after midnight, is given by the rule $T = -0.5t - 1$.

t	0	1	2	3	4	5	6
T	0						

(i) Complete the table, which gives the temperature up to 6 a.m..
(ii) Plot the points whose coordinates are given by the values in the table on a set of axes of your own.
(iii) Join the plotted points with a straight line. Do not extend the line.
(iv) From your graph, read off the temperature at 5.30 a.m..
(v) Use the rule that relates T to t to find the exact temperature at 5.30 a.m..



Exercise 17.1

16. John is given two sunflower plants. One plant is 16 cm high and the other is 24 cm high.
John measures the height of each plant at the same time every day for a week.
He notes that the 16 cm plant grows 4 cm each day, and the 24 cm plant grows 3.5 cm each day.

(i) Draw up a table showing the heights of the two plants each day for the week, starting on the day that John got them.

Day	1	2	3	4	5	6	7
1st Plant Height (cm)	16						
2nd Plant Height (cm)	24						

Exercise 17.1

16.

(ii) By taking two inputs and outputs, write two equations – one for each plant – in the form $k = \boxed{}d + \boxed{}$, where k is the height in cm and d is the day of the week (1 to 7).

Day	1	2	3	4	5	6	7
1st Plant Height (cm)	16						
2nd Plant Height (cm)	24						

Exercise 17.1

16.

(iii) John assumes that the plants will continue to grow at the same rate.
Draw graphs to represent the heights of the two plants over the first 28 days.
(Take 1 unit = 5 days on x-axis.)

Day	1	2	3	4	5	6	7
1st Plant Height (cm)	16						
2nd Plant Height (cm)	24						

Exercise 17.1

16. (iv) (a) From your diagram, write down the point of intersection of the two graphs.

(b) Explain what the point of intersection means with respect to the two plants.

Day	1	2	3	4	5	6	7
1st Plant Height (cm)	16						
2nd Plant Height (cm)	24						

Exercise 17.1

16. (v) The point of intersection can be found either by reading the graph or by using algebra.
State one advantage of finding it using algebra.

Day	1	2	3	4	5	6	7
1st Plant Height (cm)	16						
2nd Plant Height (cm)	24						

Exercise 17.1

16.

(vi) John's model for the growth of the plants might not be correct.
State one limitation of the model that might affect the point of intersection and its interpretation.

Day	1	2	3	4	5	6	7
1st Plant Height (cm)	16						
2nd Plant Height (cm)	24						

Answers 17.1

1. $(-1, -5), (0, -3), (1, -1), (2, 1), (3, 3), (4, 5)$
2. $(0, -5), (1, -3), (2, -1), (3, 1), (4, 3), (5, 5)$
3. $(-1, -7), (0, -4), (3, 5)$
4. $(0, 6), (3, 3), (6, 0)$
5. $(-2, -6), (0, -2), (3, 4)$
6. (i) 4 (ii) 1 (iii) -3 (iv) -3
   (v) 5; slope $= 1$; increasing; as y increases, x increases
7. Slope $= 2$; $y = 2x + 1$
8. (i) $(3, 4)$
   (ii) x-value of point of intersection of lines
   (iii) $x = 3$; same
   (iv) Simultaneous equations
   (v) 3
9. $(3, 2)$
10. $(2, 0), (0, 4)$
11. $(0, 3), (2, 0)$

Answers 17.1

12. $(0, 0), (10, 1), (20, 2), (30, 3), (40, 4), (50, 5)$;
    (ii) Yes; through $(0, 0)$ and linear
    (iii) $x = 10y$ (iv) 7.5ℓ
13. (i) $(0, 2)$ is on each line
    (ii) 2 is the constant
    (iii) different slopes
    (iv) different x-coefficients
    (v) $y = -x + 2$
    (vi) $y = 2x + 2$
14. $(-2, -11), (-1, -7), (0, -3), (1, 1), (2, 5), (3, 9), (4, 13)$; yes; same first difference
15. (i) $(0, -1), (1, -1.5), (2, -2), (3, -2\frac{1}{2}), (4, -3), (5, -3\frac{1}{2}), (6, -4)$
    (iv) $-3.75°$
    (v) $-3.75°$
16. (i) H_1: $(1, 16), (2, 20), (3, 24), (4, 28), (5, 32), (6, 36), (7, 40)$
    H_2: $(1, 24), (2, 27.5), (3, 31), (4, 34.5), (5, 38), (6, 41.5), (7, 45)$
    (ii) $H_1 = 4d + 12$; $H_2 = 3.5d + 20.5$
    (iv) (a) $(17, 80)$ (b) height the same
    (v) more accurate
    (vi) limit to growth