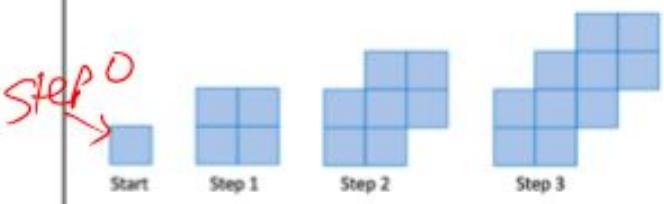
Graphs of Linear Equations

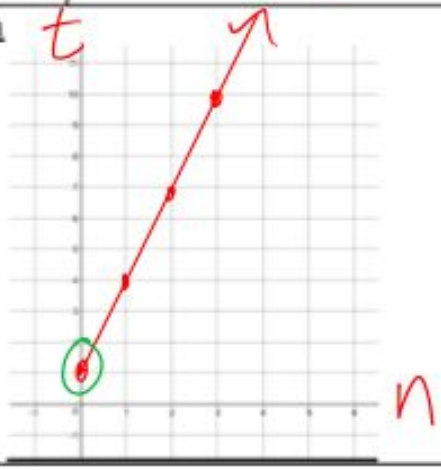
Pattern



1. Table of Values and Ordered Pairs

Step number (n)	Number of squares (t)	Ordered Pairs (n, t)
0	1	(0, 1)
1	4	(1, 4)
2	7	(2, 7)
3	10	(3, 10)

2. Graph



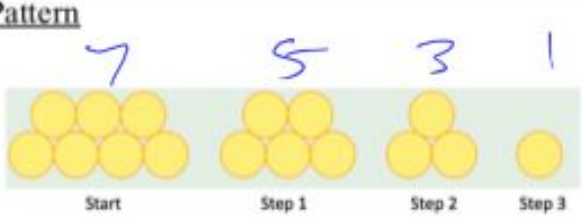
3. Equation

$3n + 1 = t$

Check: Step 3 = 10

$3(3) + 1 = 9 + 1 = 10$ ✓

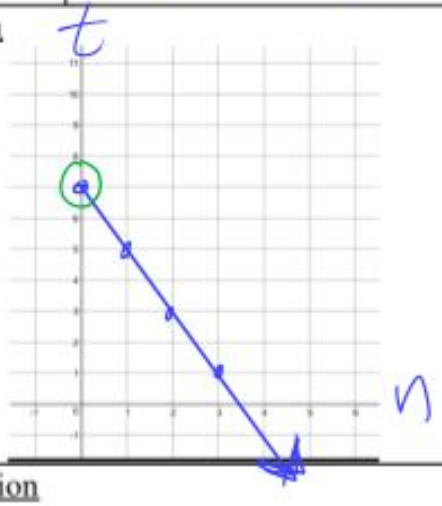
Pattern



1. Table of Values and Ordered Pairs

Step number (n)	Number of circles (t)	Ordered Pairs (n, t)
0	7	(0, 7)
1	5	(1, 5)
2	3	(2, 3)
3	1	(3, 1)

2. Graph



3. Equation

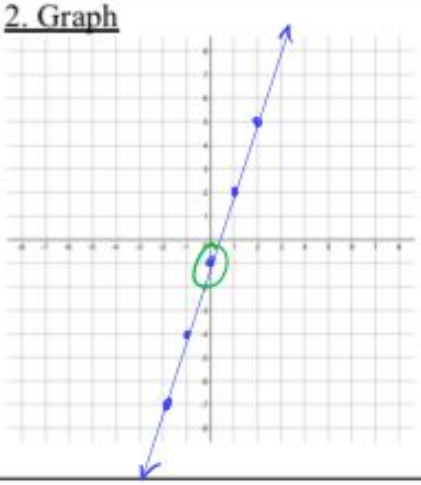
$-2n + 7 = t$

Check: Step 2 = 3

$-2(2) + 7 = -4 + 7 = 3$ ✓

*All 3 methods represent the **SAME PATTERN!***

In Section 4.1, we used a table of values to get the graph and the equation for a pattern. Let's do one more example with x and y now.

1. Table of Values and Ordered Pairs	2. Graph	3. Equation
n t x | y | (x, y) −2 | −7 | (−2, −7) −1 | −4 | (−1, −4) +3 0 | −1 | (0, −1) +3 1 | 2 | (1, 2) +3 2 | 5 | (2, 5) +3		x & y $y = 3x - 1$ ← x=0, y=−1 ← start +3 each time Check: $x = 2, y = 5$ $= 3(2) - 1 = 6 - 1 = 5$ ✓

Remember: For a linear pattern, there are **two** important features:

1. Common difference
2. Start

When we talk about equations of lines (especially when we use x and y) we use different names for the same two things:

y – intercept: where the graph touches the y-axis (x=0)

which is the same as: Start

• Start
• Step 0

slope: how much the graph increases/decreases when you move 1 to the right (each step)

which is the same as: common difference

The linear equation: $y = 3x - 1$ has a y-intercept = −1 (start) and a slope = 3 (CD)

The linear equation: $y = \frac{1}{2}x + \frac{4}{3}$ has a y-intercept = 4/3 and a slope = 1/2

The linear equation: $y = 1x - 2$ has a y-intercept = −2 and a slope = 1

The linear equation: $y = -1x + 0$ has a y-intercept = 0 and a slope = −1

(In this example, the y-intercept = 3 and the slope = -2)

Step 1: Create a table of values and ordered pairs that match with the equation
Step 2: Plot the points on a graph and join them as a line, with arrows on both ends

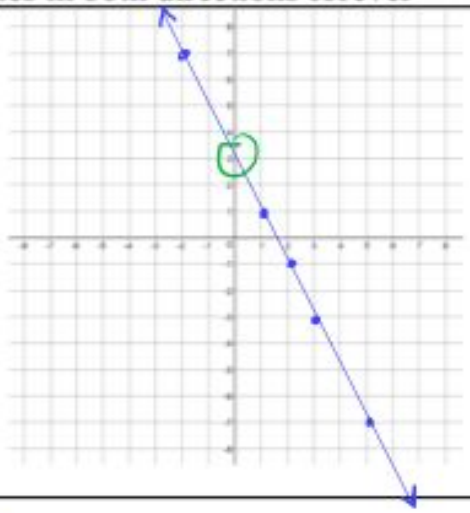
*(Note: You can choose **ANY** values for x, then use those values to calculate y)*

1. Table of Values and Ordered Pairs	2. Graph
Choose 5 different x values **Calculate** the y values that match. **Write** the ordered pairs!	**Plot** the points and **join** them as a line. **Draw** arrows on both ends to show it continues in both directions forever

$y = -2x + 3$ ← y-int

$y = -2(1) + 3 = 1$
$y = -2(2) + 3 = -1$
$y = -2(5) + 3 = -7$
$y = -2(3) + 3 = -3$
$y = -2(-2) + 3 = 7$

x	y	(x, y)
1	1	(1, 1)
2	-1	(2, -1)
5	-7	(5, -7)
3	-3	(3, -3)
-2	7	(-2, 7)
0	3	



Example #2: $3y - x + 9 = 0$ (slope, y-int)

(In this example, we need to convert into y=mx+b form first!)
(The y-intercept = -3 and the slope = 1/3)
Find 5 ordered pairs that match with the equation, then draw the graph

Convert into y=mx+b form:

Isolate for y
↳ get on its own

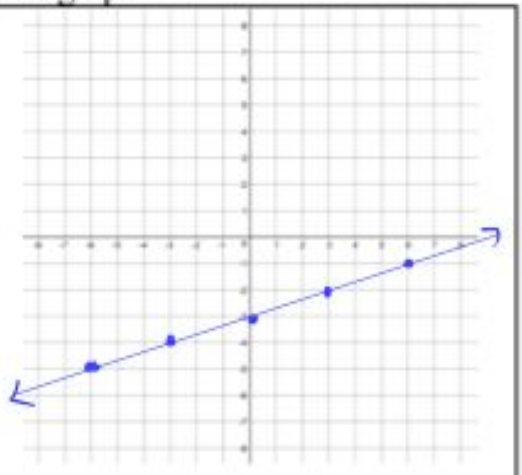
$3y - x + 9 = 0$
$+x \quad -9 \quad +x \quad -9$
$\div 3 \quad 3y = (x - 9) \div 3$

$y = \frac{x}{3} - 3$ ← y-int

$y = \frac{3}{3} - 3 = 1 - 3 = -2$ ← fun!!

$y = \frac{6}{3} - 3 = 2 - 3 = -1$
$y = \frac{-3}{3} - 3 = -1 - 3 = -4$
$y = \frac{-6}{3} - 3 = -2 - 3 = -5$

(x, y)
(0, -3)
(3, -2)
(-3, -4)
(6, -1)
(-6, -5)



(It makes life easier if we pick multiples of 3 so that we don't have to graph fractions)

Example #3: In January, the temperature (T) outside Lord Byng is given by the equation $T = 2h - 5$ where h is the number of hours after school starts.

In this example, we should put h on the x-axis and T on the y-axis.

The y-intercept = −5 and the slope = 2

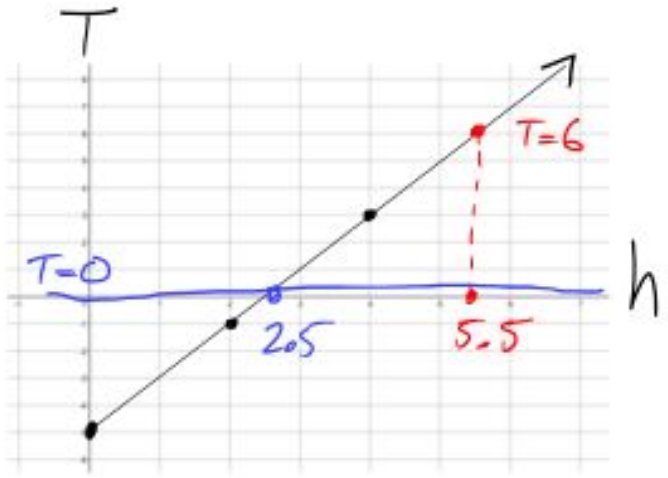
a) Find the temperature outside Byng zero, two and four hours after school starts.

$T = 2(0) - 5 = -5$ $(0, -5)$

$T = 2(2) - 5 = 4 - 5 = -1$ $(2, -1)$

$T = 2(4) - 5 = 8 - 5 = 3$ $(4, 3)$

b) Graph the equation



c) **Using the graph**, estimate the temperature outside Byng 5 ½ hours after school starts.

$h = 5.5$ $T = 6$

Check $2(5.5) - 5 = 11 - 5 = 6$ ✓

d) **Using the graph**, estimate how many hours after school starts is the temperature 0 degrees.

$T = 0 \Rightarrow h = 2.5$

Check $T = 2h - 5$

$= 2(2.5) - 5 = 0$ ✓

Homework: Section 4.2 # 4-5all, 6all, 7left, 8 (a-f), 10, 12, 13