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WHICH IS BIGGER?

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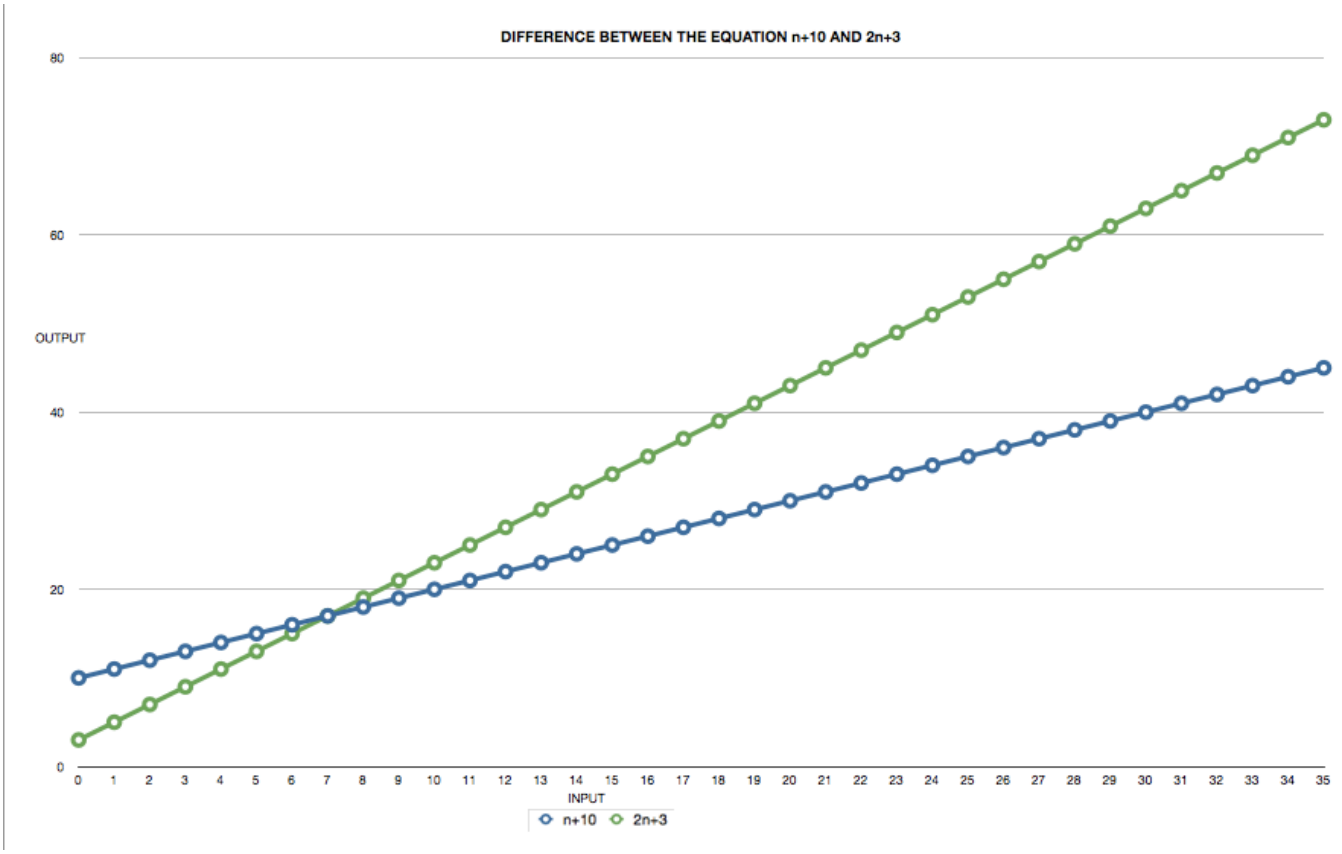
I've been challenged to find which is bigger, n+10 or 2n+3 if, Charlie says n=4, n+10 is bigger and Alison when n=10, 2n+3 is bigger.

n+10			2n+3	
Input	Output		Input	Output
0	10		0	3
1	11		1	5
2	12		2	7
3	13		3	9
4	14		4	11
5	15		5	13
6	16		6	15
7	17		7	17
8	18		8	19
9	19		9	21
10	20		10	23
11	21		11	25
12	22		12	27
13	23		13	29
14	24		14	31
15	25		15	33
16	26		16	35
17	27		17	37
18	28		18	39
19	29		19	41
20	30		20	43
21	31		21	45
22	32		22	47
23	33		23	49
24	34		24	51
25	35		25	53
26	36		26	55
27	37		27	57
28	38		28	59
29	39		29	61
30	40		30	63
31	41		31	65
32	42		32	67
33	43		33	69
34	44		34	71
35	45		35	73



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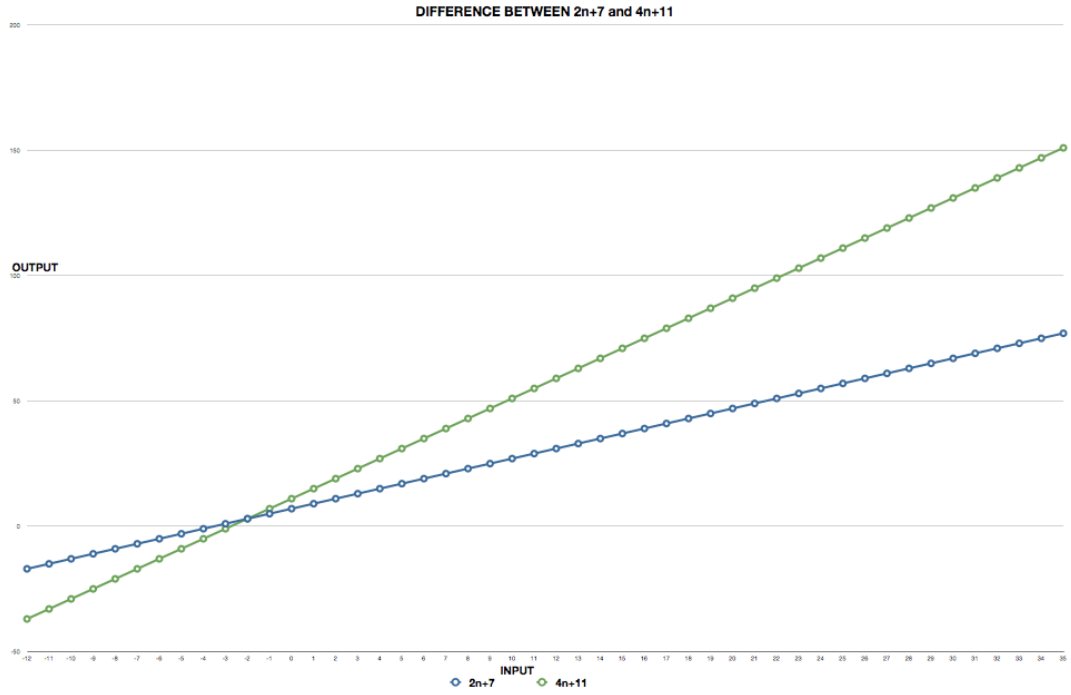
In this chart and graph we can see that when n is lower than 7, n+10 is larger. When n is higher than 7, 2n+3 is greater and when n is 7 they are both equal.

This is the reason why Alison and Charlie got different conclusions. The real answer is that if n>7, 2n+3 is greater and when n<7, n+10 is greater and if n=7 then they're both equal.

A similar comparison can be made with the equations 2n+7 and 4n+11. In this case, if n>-2, 4n+11 is bigger and when n<-2, 2n+7 is larger.

2n+7			4n+11	
Input	Output		Input	Output
-12	-17		-12	-37
-11	-15		-11	-33
-10	-13		-10	-29
-9	-11		-9	-25
-8	-9		-8	-21
-7	-7		-7	-17
-6	-5		-6	-13
-5	-3		-5	-9
-4	-1		-4	-5
-3	1		-3	-1
-2	3		-2	3
-1	5		-1	7
0	7		0	11
1	9		1	15
2	11		2	19
3	13		3	23
4	15		4	27
5	17		5	31
6	19		6	35
7	21		7	39
8	23		8	43
9	25		9	47
10	27		10	51
11	29		11	55
12	31		12	59
13	33		13	63
14	35		14	67
15	37		15	71
16	39		16	75
17	41		17	79
18	43		18	83
19	45		19	87
20	47		20	91
21	49		21	95
22	51		22	99
23	53		23	103
24	55		24	107
25	57		25	111
26	59		26	115
27	61		27	119
28	63		28	123
29	65		29	127
30	67		30	131
31	69		31	135
32	71		32	139
33	73		33	143
34	75		34	147
35	77		35	151



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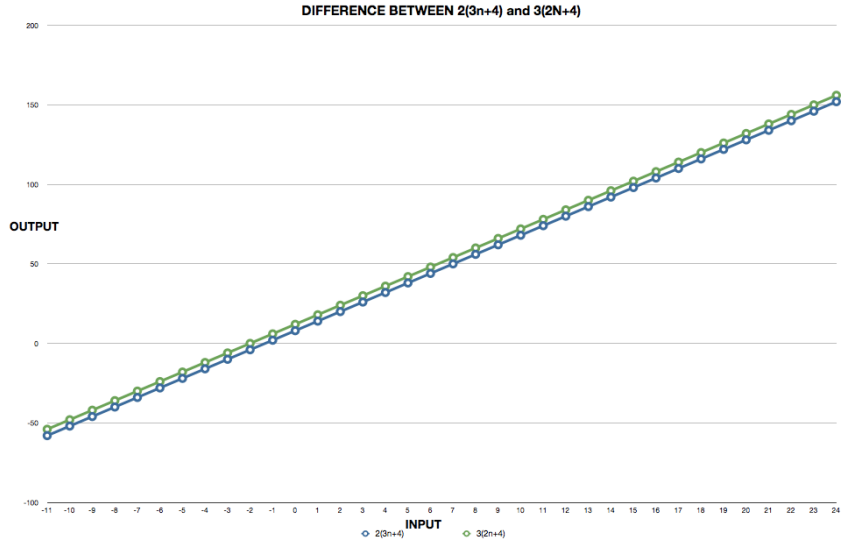
In this case, the difference between any number when the n is constant will remain 4. This will mean that the lines will never intersect and this means that 3(2n+4) is bigger than 2(3n+4).

2(3n+4)	
Input	Output
-11	-58
-10	-52
-9	-46
-8	-40
-7	-34
-6	-28
-5	-22
-4	-16
-3	-10
-2	-4
-1	2
0	8
1	14
2	20
3	26
4	32
5	38
6	44
7	50
8	56
9	62
10	68
11	74
12	80
13	86
14	92
15	98
16	104
17	110
18	116
19	122
20	128
21	134
22	140
23	146
24	152
25	158
26	164
27	170
28	176
29	182
30	188
31	194
32	200
33	206
34	212
35	218

3(2n+4)	
Input	Output
-11	-54
-10	-48
-9	-42
-8	-36
-7	-30
-6	-24
-5	-18
-4	-12
-3	-6
-2	0
-1	6
0	12
1	18
2	24
3	30
4	36
5	42
6	48
7	54
8	60
9	66
10	72
11	78
12	84
13	90
14	96
15	102
16	108
17	114
18	120
19	126
20	132
21	138
22	144
23	150
24	156
25	162
26	168
27	174
28	180
29	186
30	192
31	198
32	204
33	210
34	216
35	222



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Like this we can find two different expressions when we are given the intersection. We do this by taking a graph paper and drawing a line graph. Then you have to find the intersection. Then you have to draw two lines that intersect each other. Now you have to find the equation of the line by making two points on the line and use the following formula to find the equation/slope of the line.

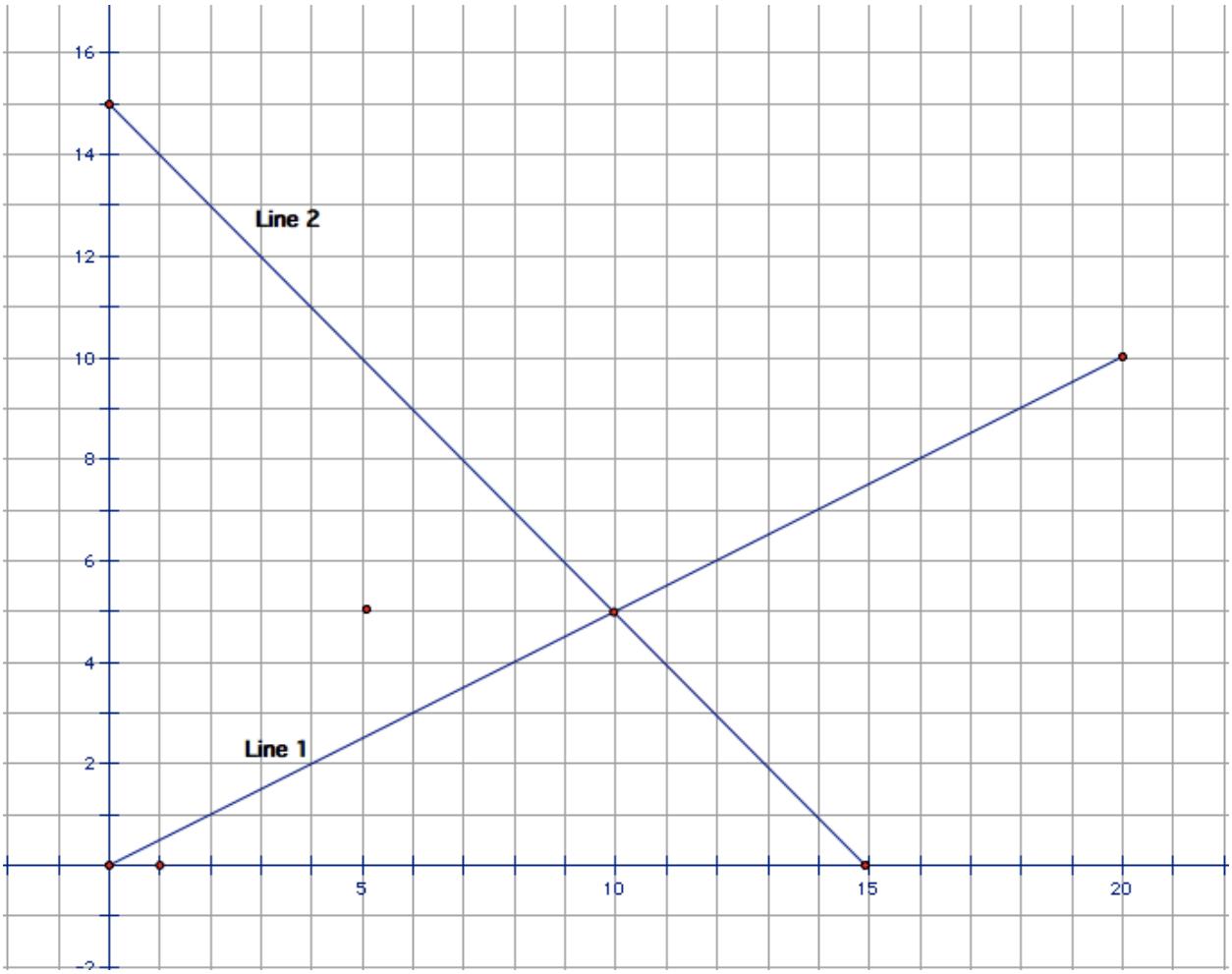
y=mx+c.

$$M = \frac{\text{The change in y}}{\text{The change in x}}$$

C=Y-Intercept (intersection between the line and the y-axis)

eg. Find two expressions so that one is bigger whenever $n < 5$ and the other is bigger whenever $n > 5$.

Step 1: Find the intersection.
Intersection is 5 since n<5 and n>5
Step 2: Draw to random lines.
Step 3: Use the formula (y=mx+c).



For each equation there could be many possible lines intersecting at the given point.
Equation for line 1:2n
Equation for line 2:-n+15

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We can also try this method over and over again to solve different problems, for example if we are told:

Find three expressions so that the first is biggest whenever n $<$ 0, the second is biggest whenever n is between 0 and 4, and the third is biggest whenever n $>$ 4.

We can do the same thing for the this case. Except we have to find different intersections.

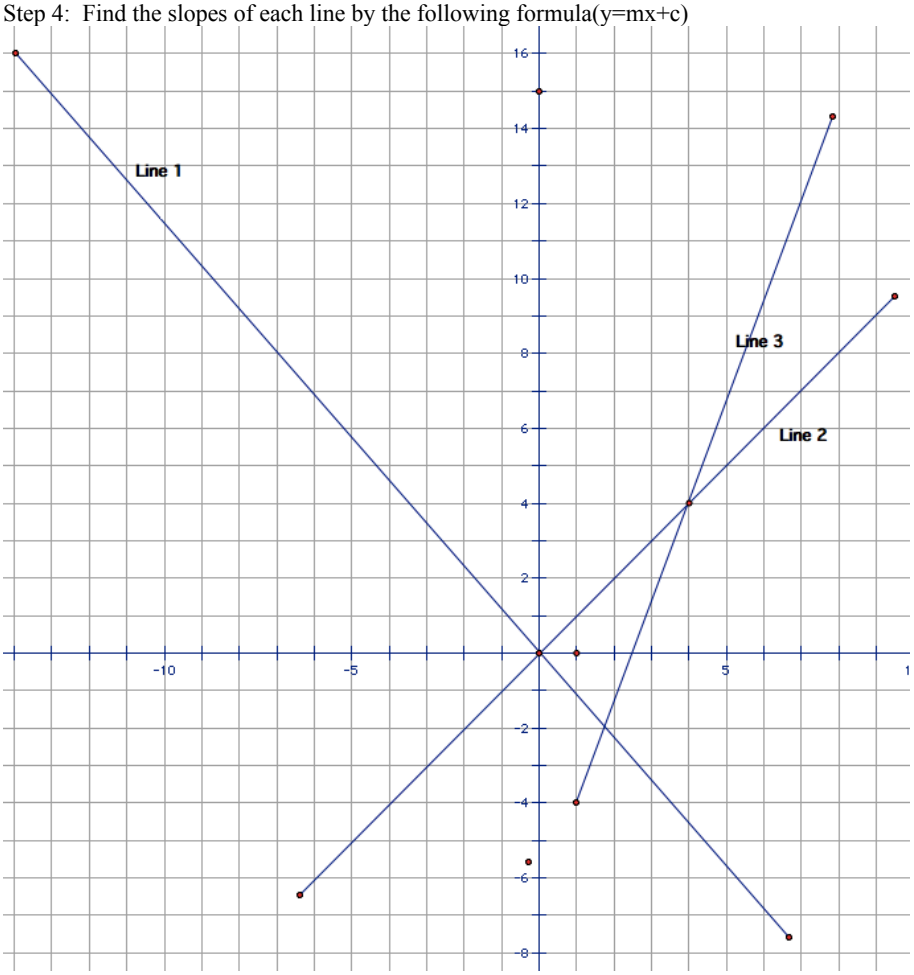
This is how you do it:

Step 1: Make a random line that goes down which touches y=0.

Step 2: Make a random line that goes up which intersects the other line at y=0

Step 3: Make a random line that goes up and intersects the 2nd line at y=4, however doesn't go over the first line at 0 or before 0.

Step 4: Find the slopes of each line by the following formula(y=mx+c)



There could be several answers for this problem.

Equation for Line 1: -1.143n

Equation for Line 2: n

Equation for Line 3: 2.66...n

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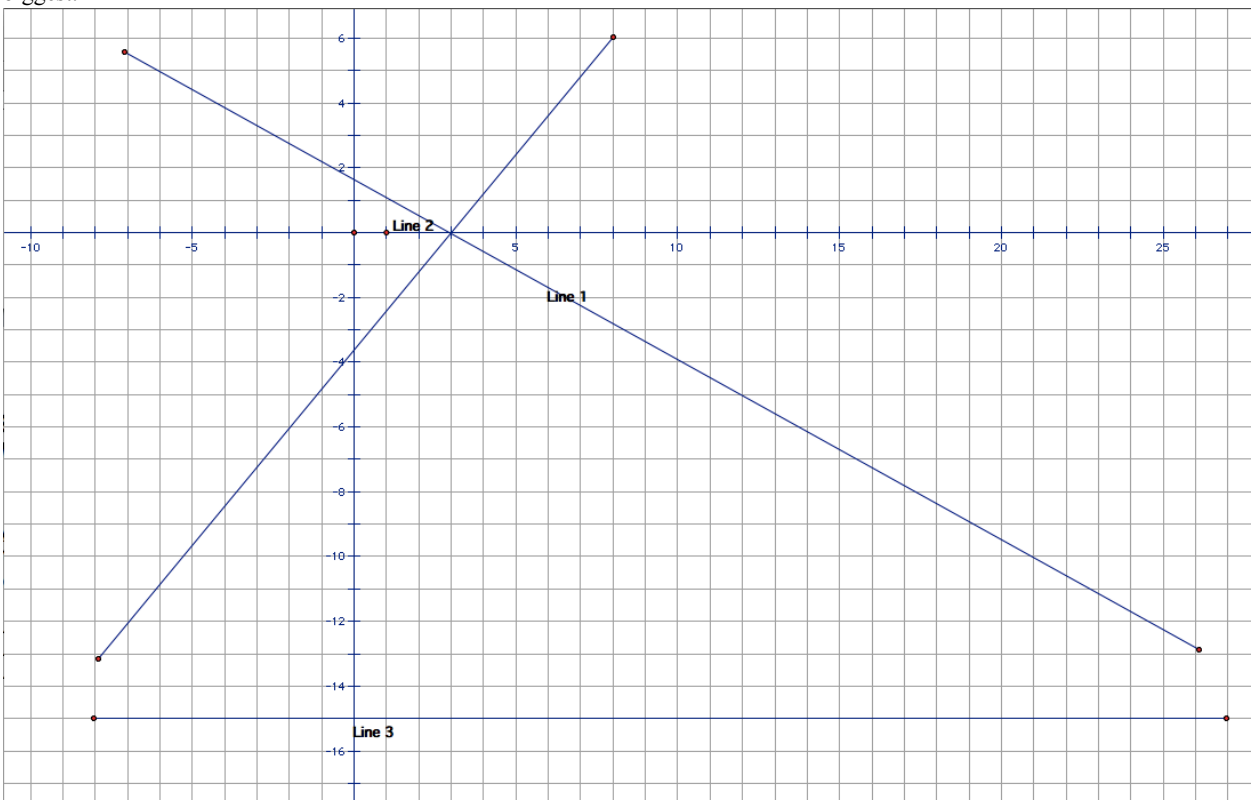
Another example is:
Find three expressions so that the first is biggest whenever $n<3$, the second is biggest when $n>3$, and the third is never the biggest.



There could be answers for this problem
Equation for Line 1:-1.5n+0.5
Equation for Line 2: 1.2n-3.5
Equation for Line 3: -15

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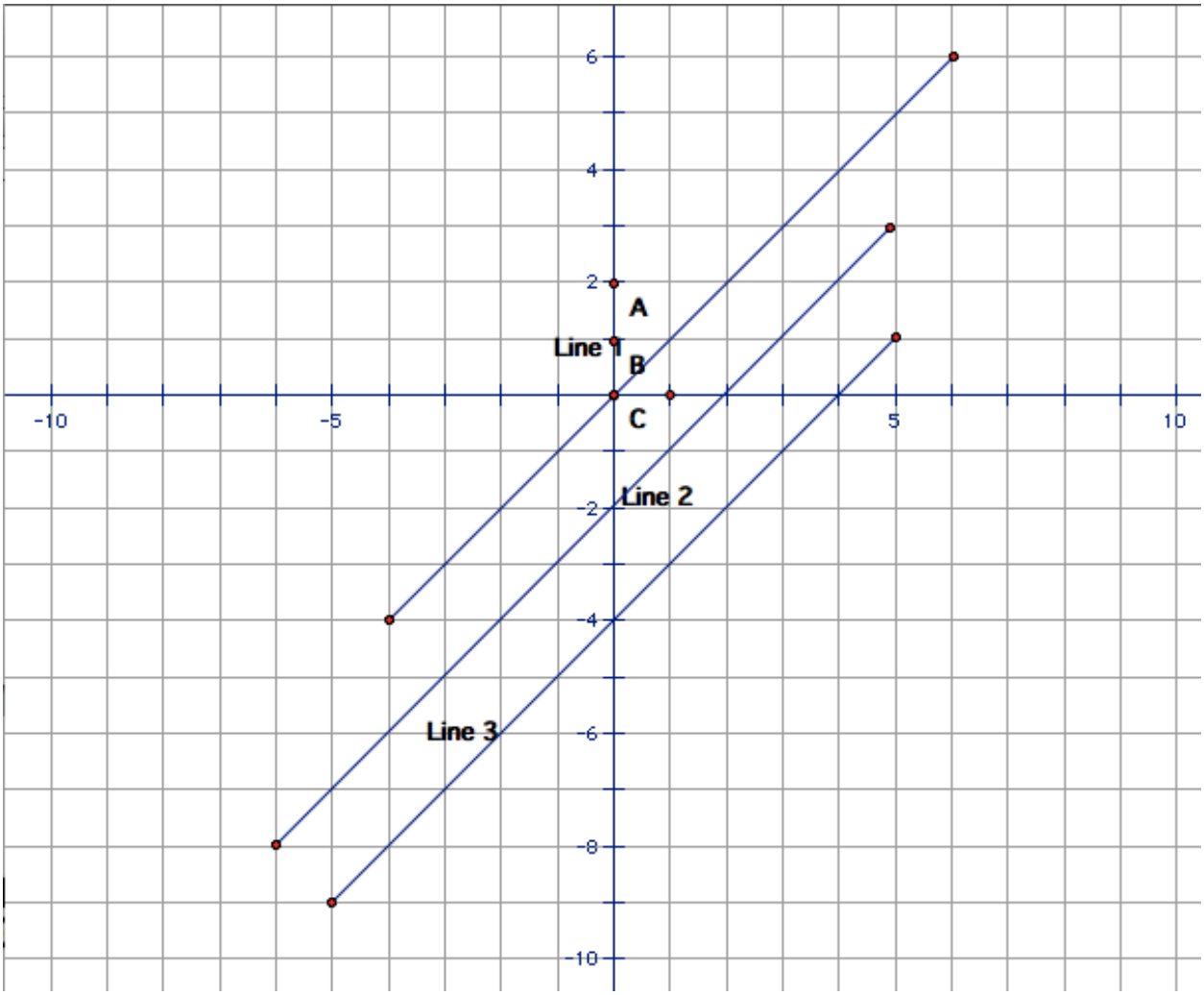
Another example:

Find three expressions so that one of them is the biggest regardless of the value of *n*.

Step 1: Draw three parallel lines.

Step 2: Drag one point further away on the y-axis.



Equation for Line 1: n
Equation for Line 2: n-2
Equation for Line 3: n-4

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