BOOKLET #1
# LINEAR EQUATIONS
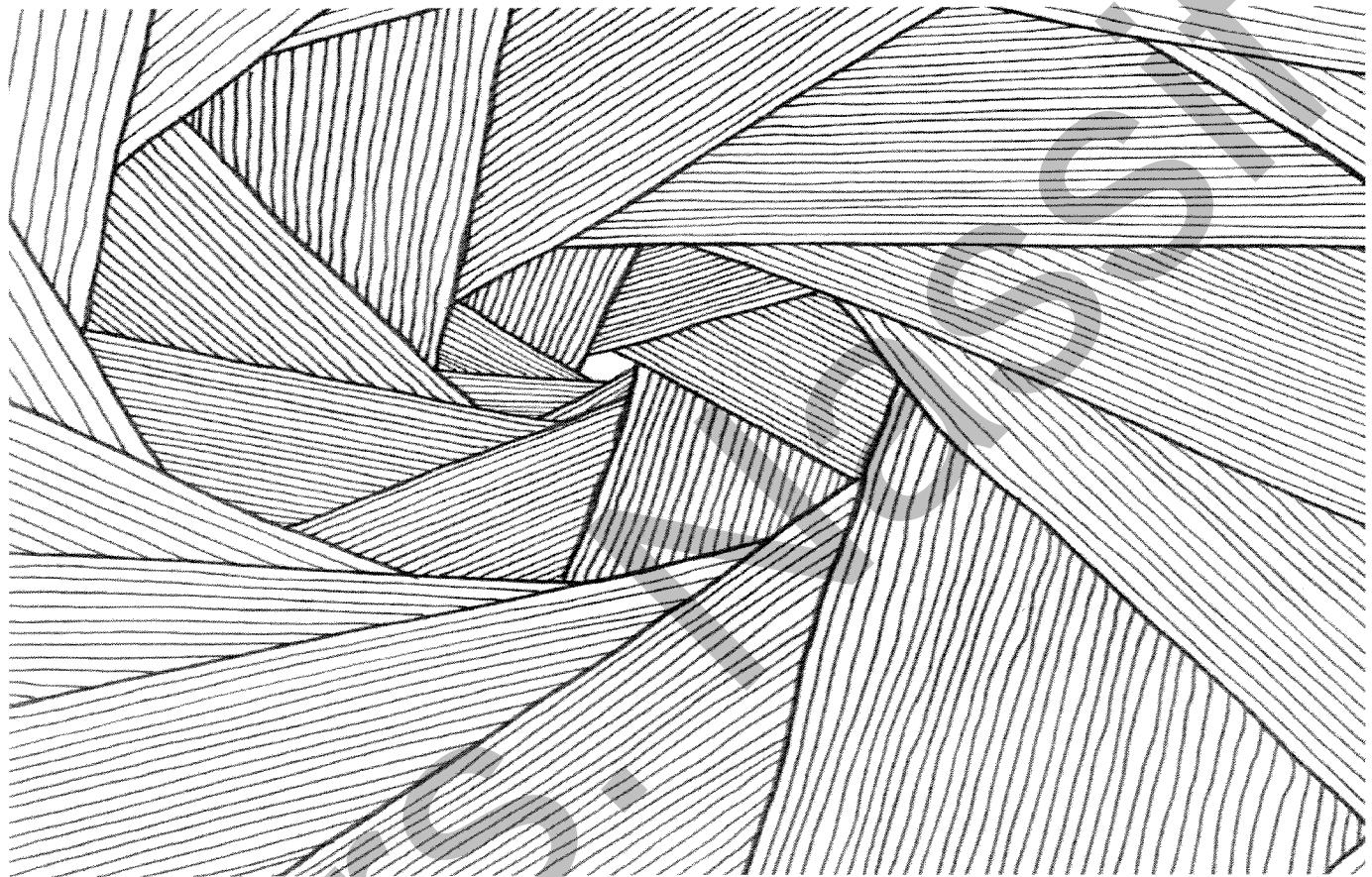
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Concept Checklist:

- ✓ Adding and subtracting like-terms
- ✓ Solving equations
- ✓ Plot coordinates
- ✓ Calculate the slope
- ✓ Calculate the equation of a line
- ✓ Graph the equation of a line
- ✓ Find the x and y intercepts
- ✓ Writing the equation given a description

Adding and Subtracting Like Terms

1. State whether the following are like terms, or not.

   YES/NO

   a) $2x + 5x$ _____

   b) $15x^2 + 2$ _____

   c) $18xy^2 + 2x^1y^2$ _____

   d) $8x^3 + 4x^2$ _____

   e) $6xy^2 + 12y^2x$ _____

   f) $3xy + 4x$ _____

2. Combine the 'like terms' into a simpler expression

   a) $2x + 6x - 1$

   b) $9x + 10y - 5 - 2y + 11x$

   c) $2x - 6x - 3$

   d) $-4x - 10x + 5 + 14x^2 - 8$

   e) $-14 - 12x - 3x^2 - 6x + 3x^2$

   f) $3x + 2x - 3 - 3x + 9$

3. Simplify the following expressions.

a) $4 + 3 + (7 + 2)$

b) $4 + 3 - (7 - 2)$

c) $2x + 4 + (-3x - 2)$

d) $6x^2 - 3x^2 + (3 - 4x^2 - 2)$

e) $7x - 9 - (4x + 3)$

f) $-6x + 3x^2 - (-5x^2 - 6x)$

g) $-18x + 2 + 8x - (12x + 2)$

h) $8xy + 5 - 4yx - (-5 + 4xy)$

2

A. Simplify the following expressions:

1. $5a + 3a$ 2. $6a - 4a$ 3. $4a + a$ 4. $x + x + x + x$

5. $a - a$ 6. $3a + 2a - 5a$ 7. $3a + 5c - a + 2c$

8. $3x + 2x + 3y - y$ 9. $3x - x + 3 - 2$

10. $3x + y - x + 4y$ 11. $3x + 2y - 3x + 4y$

12. $2x + 5y - 3y + x$ 13. $p + q - p - q$

14. $p + q + p + q + p$ 15. $4p - 5p$

16. $5c + 2d - 3c - 4d$ 17. $5x - 3y + 2x - 4y$

18. $5p - 3q + 2 - 4p + 5 + 4q$ 19. $2ac + 3ac - 4ac$

20. $xy + yx$ 21. $2xy - 4ac + 5yx + 4ac$

22. $3xy + 4xy - xy$ 23. $3cd - 4cd + cd$

24. $xy + yx - 2xy + 1$ 25. $2ab + 3cd - 4ab - 3cd$

26. $4y^2 - 3y^2$ 27. $4x^3 - x^3$

28. $3x^2 + y^3 - x^2 - y^3$ 29. $4y^2 + 5y - 3y^2 - 4y$

30. $2x^2 + 3x - 5x^2 - x + 8$ 31. $x^2 + x^2 + x^2$

32. $x^2 + x^2 + 3x^2$ 33. $x^2 + x^2 - x^2$

34. $x^2y + xy + x^2y$ 35. $x^2y + xy^2 - x^2y + 2y^2x$

3

B. Expand the brackets and simplify where possible.

1. $4(x-3)$

2. $4(2x-3)$

3. $2(3-4y)$

4. $x(x+1)$

5. $x(x-2)$

6. $x(x^2+4x-3)$

7. $y(x-y^2)$

8. $4(p+2)+3(2p-3)$

9. $2(3p+2)+3(2p-3)$

10. $3(2p-5)+2(3p-3)$

11. $2p(p+2)+3p(2p-3)$

12. $3p(p-2)+2p(3p-2)$

13. $2p(p-3)+3p(3p-2)$

14. $x(x^2-2y)+3x^2(x+2y)$

15. $-(x-3)$

16. $-4(2x-3)$

17. $-2(3-4y)$

18. $-x(x+1)$

19. $-x(x-2)$

20. $-x(x^2+4x-3)$

21. $-y(x-y^2)$

22. $7(p+2)-3(2p-3)$

23. $2(3p+2)-3(2p-3)$

24. $3(2p-5)-2(3p-3)$

25. $2p(p+2)-3p(2p-3)$

26. $3p(p-2)-2p(3p-2)$

27. $2p(p-3)-3p(3p-2)$

28. $3(x-2y)-2(x-3y)$

29. $2(3x+1)-5(2x-3)$

30. $x(x^2-2y)-3x^2(x+2y)$

31. $2(3x+1)-(2x-3)$

32. $2(p-4)+3(2p-1)$

33. $a(a+2b-3c)+3c(a-2b+3c)-2b(a-b-3c)$

34. $a(b-c+d)-a(b-c+d)$

35. $3a(2b-3c+4d)-2a(3b-c+6d)$

36. $5-2(x-3)$

37. $6+4(3-x)$

38. $6+(2x+6)$

39. $6-(2x+6)$

40. $2x^2(4xy-5)-8yx^3+9x^2$

4

C. Solve the following equations:

1. $x + 3 = 9$
2. $2x = 6$
3. $4 - x = 5$
4. $2x + 3 = 13$
5. $2x = 1$
6. $3x = 2$
7. $4x = 20$
8. $4x - 1 = 19$
9. $4x = -20$
10. $2x = -6$
11. $4x = -8$
12. $4x = -1$
13. $2x + 3 = -5$
14. $2x - 3 = 5$
15. $2x - 3 = x + 2$
16. $7x - 3 = 2x + 12$
17. $7y - 8 = 5y + 2$
18. $4x + 5 = 2x - 11$
19. $5x - 6 = 2x - 15$
20. $x + 2x = -15$
21. $3x - 5 = 4x - 7$
22. $2x + 7 = 5x - 3$
23. $2x + 7 = 12 - 3x$
24. $6y - 2 = 8y - 5$
25. $8 - 4x = 10 - 2x$
26. $12 = 3x - 6$
27. $3(x - 5) = 12$
28. $5(2x - 3) = 15$
29. $5(3 - 2x) = 30$
30. $3(2x - 4) = 8$
31. $7x + 2 = 5(x - 2)$
32. $22 - 3x = 2(x + 6)$
33. $13 - 3x = 4(x - 2)$
34. $x - 18 = 2(2x - 3)$
35. $4(2x - 3) = 3x - 27$
36. $3(2x - 5) = 6 + 2(x - 3)$
37. $4 - (3x - 5) = 6 - (2x + 7)$
38. $x(x + 5) = x^2 - 15$
39. $3x(2 + x) = x(3x - 2) - 24$
40. $3(x - 4) - 2(x - 5) = 6x - 2(x - 5)$

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Plot each ordered pair. Connect the dots as you go. When it says "Stop," start a new line segment.
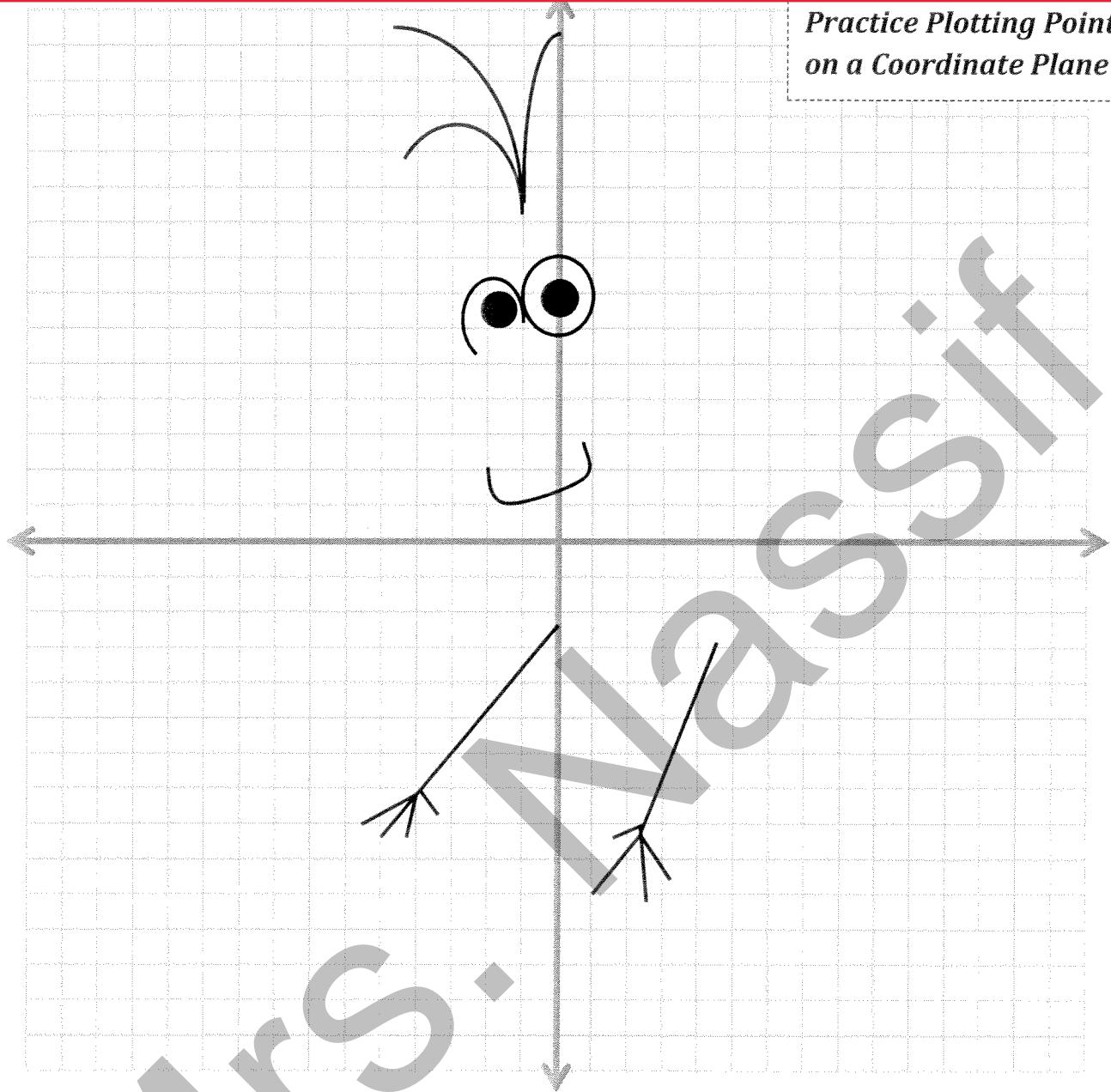
Graph these points in order to create the picture of a much-beloved fictional character.

Shape 1:	Shape 2:		Shape 3:	Shape 4:	Shape 5:	
(5, -6)	(-2, -10)	(0, -10)	(0, 5)	(-3, -8)	(-3, 2)	(-3, 2)
(6, -4)	(-2, -9)	(2, -9)	(-1, 6)	(-2, -6)	(0, -1)	(0, 2)
(5, -2)	(-3, -8)	(4, -10)	(-2, 6)	(0, -4)	(2, -2)	(2, 4)
(4, -1)	(-5, -8)	(4, -11)	(-3, 3)	(3, -6)	(4, -1)	(3, 6)
(2, -2)	(-6, -9)	(3, -13)	(0, 5)	(5, -6)	(4, 6)	(2, 1)
(0, -1)	(-6, -11)	(1, -13)	STOP	(7, -7)	(0, 10)	(1, 0)
(0, -4)	(-5, -12)	(0, -12)		(7, -9)	(-3, 8)	(0, 0)
STOP	(-2, -11)	(0, -11)		(6, -11)	(-3, 6)	(-1, 1)
	(-2, -10)	STOP		(4, -11)	(-4, 5)	STOP
	(0, -11)			STOP	(-4, 4)	

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Reading points on a cartesian plane

Why did the teacher always wear sunglasses in her classroom?

Crack the code below.
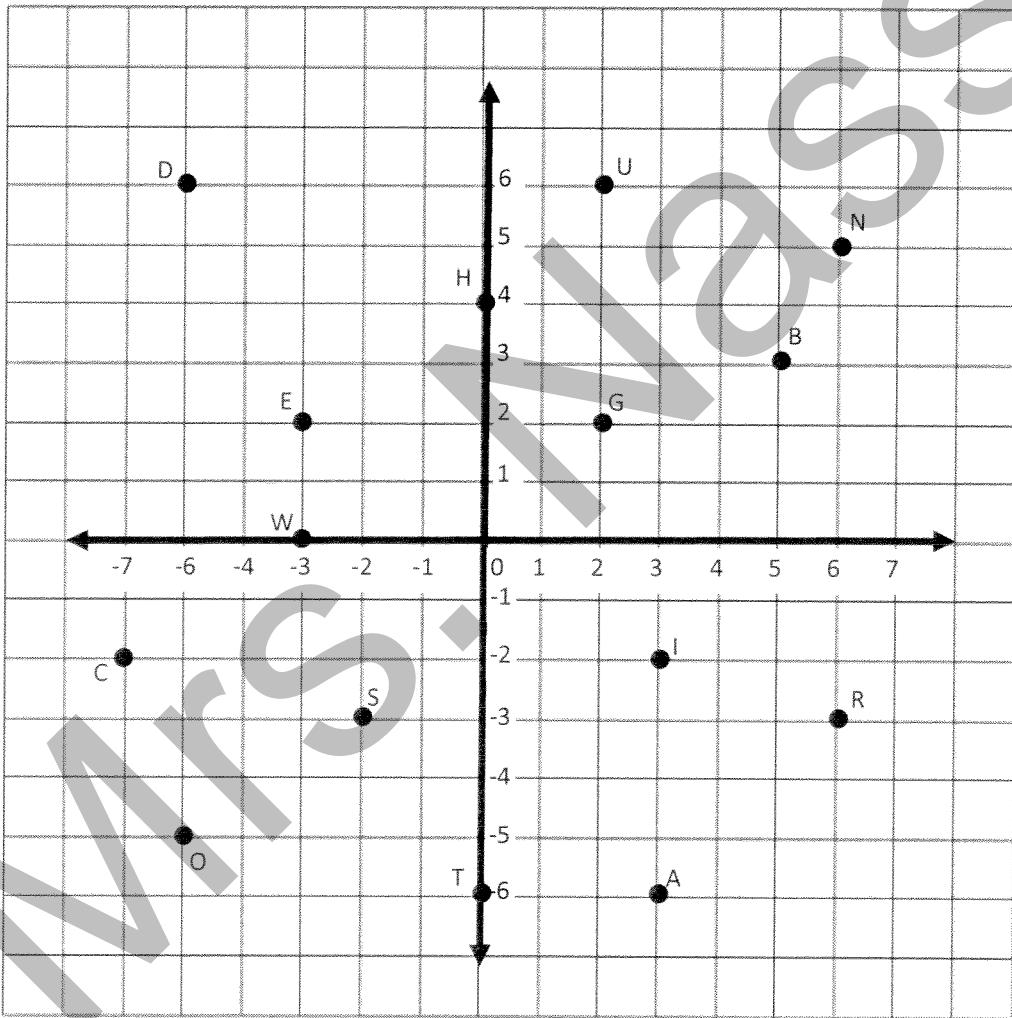
Answer:

___ ____ ____ ____ ____ ____ ____ | ____ ____ ____ | ____ ____ ____ ____ ____ ____ ____ ____|

(5,3) (-3,2) (-7,-2) (3,-6) (2,6) (-2,-3) (-3,2) | (0,4) (-3,2) (6,-3) | (-2,-3) (0,-6) (2,6) (-6,6) (-3,2) (6,5) (0,-6) (-2,-3)|

___ ____ ____ ____ | ____ ____ | ____ ____ ____ ____ ____ ____

(-3,0) (-3,2) (6,-3) (-3,2) | (-2,-3) (-6,-5) | (5,3) (6,-3) (3,-2) (2,2) (0,4) (0,-6)

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SLOPE

1. Find the slope from each of the given pairs of coordinates.

a) (3, 5) and (4, 1) Slope: _____	b) (6, 2) and (3, 2) Slope: _____
c) (0, -3) and (7, -1) Slope: _____	d) (5, 5) and (6, 4) Slope: _____
e) (7, 6) and (8, 9) Slope: _____	f) (-2, -4) and (-1, -3) Slope: _____
g) (-3, -5) and (0, 0) Slope: _____	h) (3, 5) and (3, -1) Slope: _____

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2. Find the slope from the graphs below.

a)
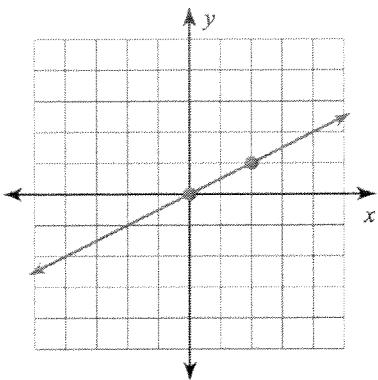
Slope: a = _____

b)
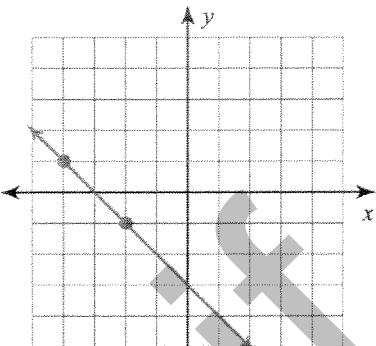
Slope: a = _____

c)

Slope: a = _____

d)

Slope: a = _____

9
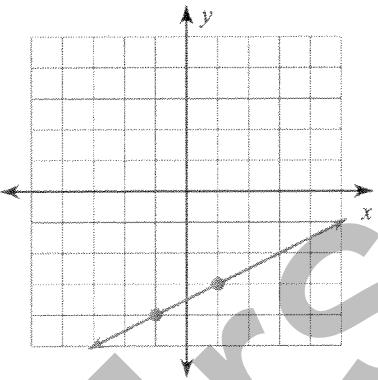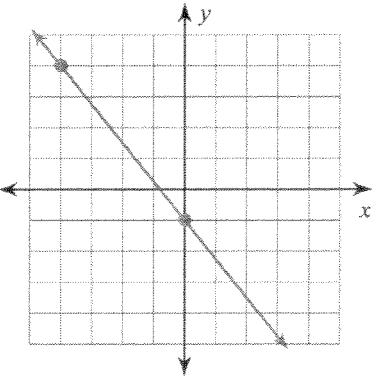
e)
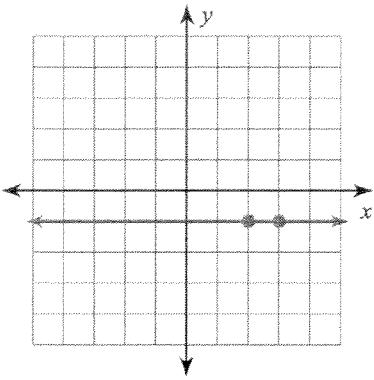
Slope: a = _____

f)
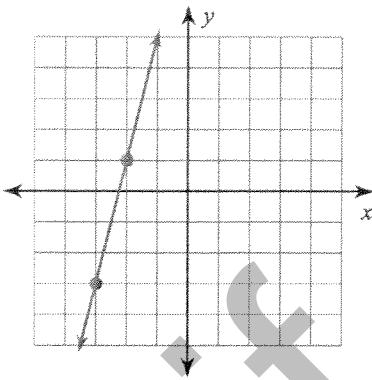
Slope: a = _____

g)

Slope: a = _____

h)

Slope: a = _____

10
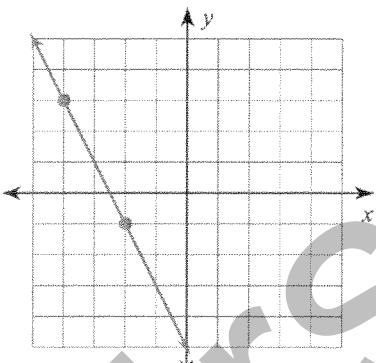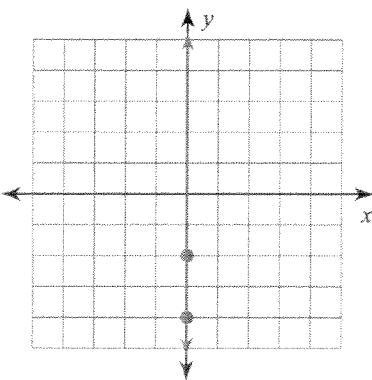
Calculate the slope given a table of values.

1.

X	Y
0	1
1	1
2	1
4	1
5	1

4.

X	Y
-10	10
-5	7
0	4
5	1
10	-2

2.

X	Y
-4	-4
0	-2
4	0
8	2
12	4

5.

X	Y
-4	4
-1	3
2	2
5	1
8	0

3.

X	Y
-2	-3
-1	-1
0	1
1	3
2	5

6.

X	Y
-3	-6
0	0
3	6
4	8
5	10

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LINEAR EQUATIONS

Write the equation (y = ax + b) for each line.
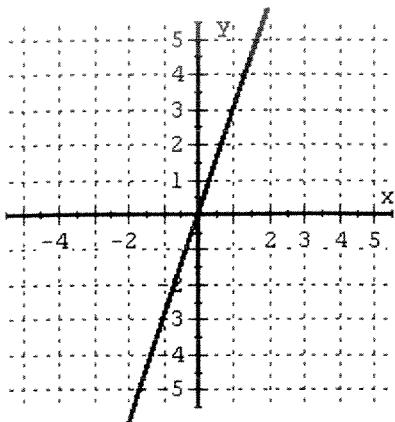
1) _____
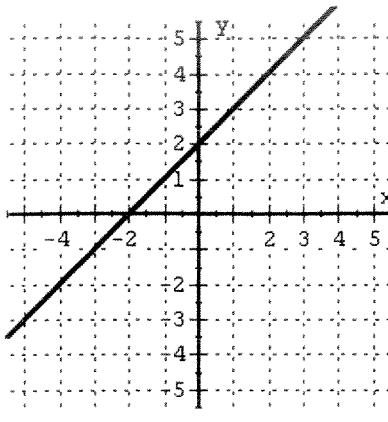
2) _____
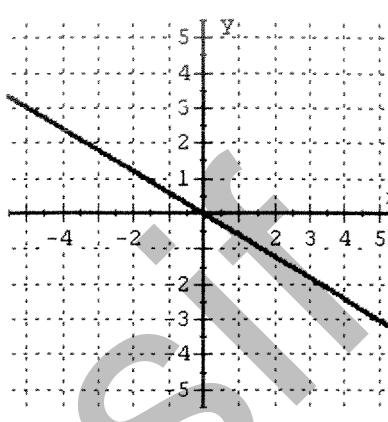
3) _____
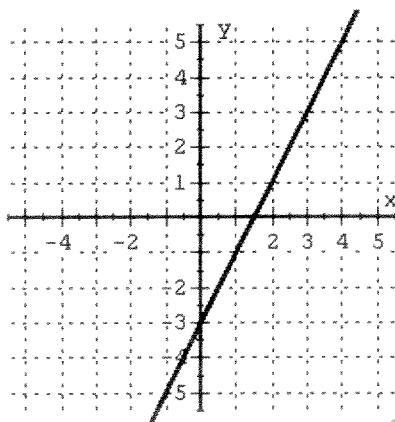
4) _____
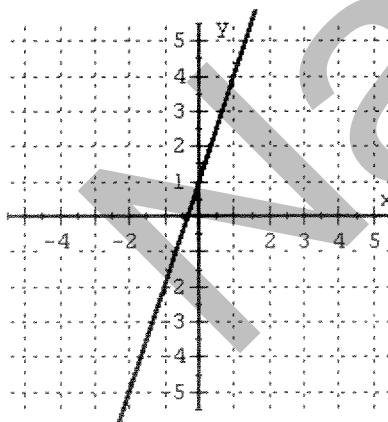
5) _____
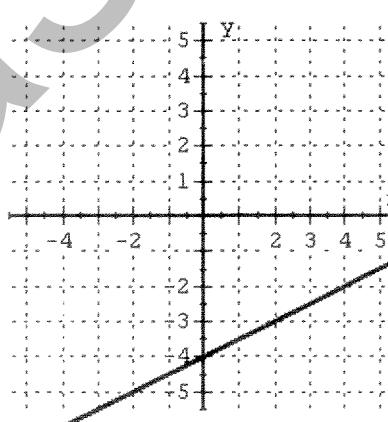
6) _____
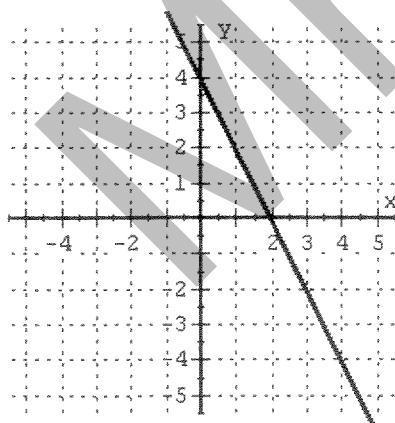
7) _____
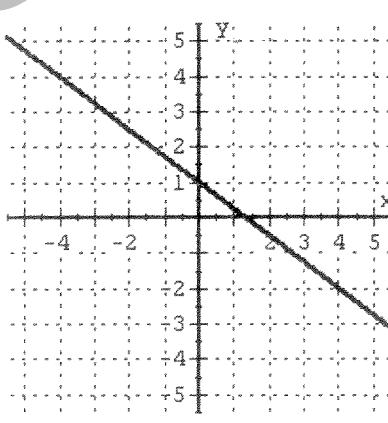
8) _____
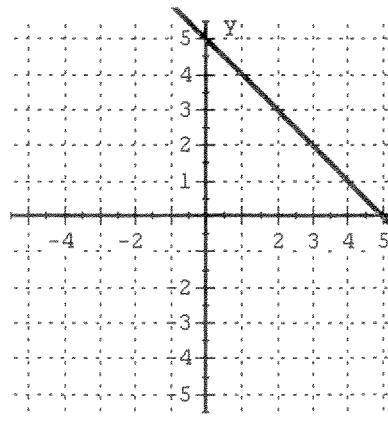
9) _____

EXCEPTIONS TO y= ax+b

1. Identify the slope and y-intercept, then write the equation of the line in the Cartesian-grid below:

$(0, 3)$ $(6, 3)$

2. Identify the slope and y-intercept, then write the equation of the line in the Cartesian-grid below:

$(0, -4)$ $(6, -4)$

3. Identify the slope and y-intercept, then write the equation of the line in the Cartesian-grid below:

$(2, 3)$

$(2, 0)$
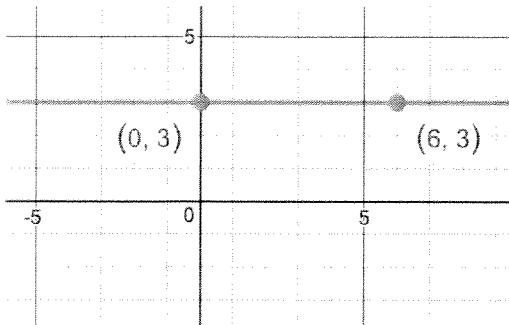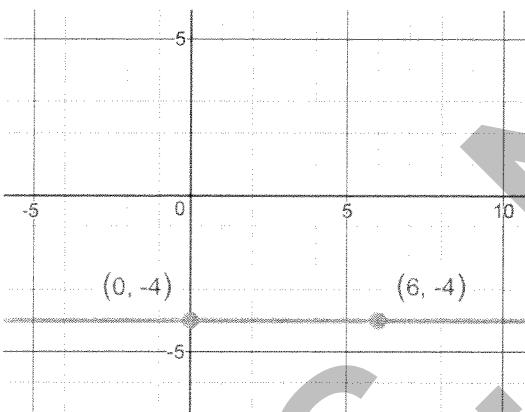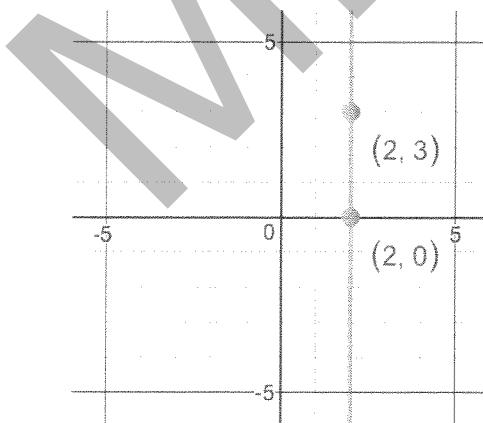
4. Identify the slope and y-intercept, then write the equation of the line in the Cartesian-grid below:
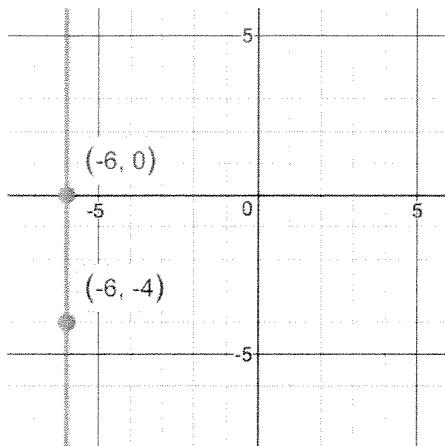
5. Identify the slope and y-intercept, then write the equation of the line in the Cartesian-grid below:
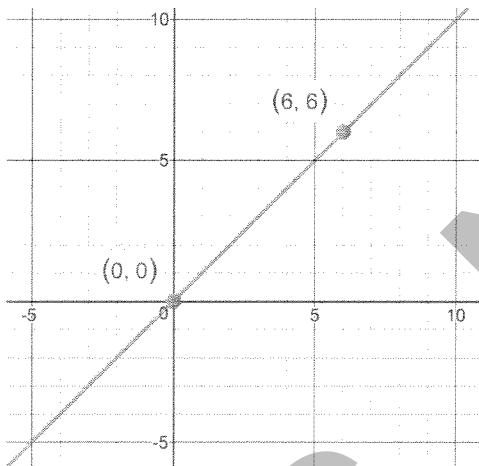
6. Identify the slope and y-intercept, then write the equation of the line in the Cartesian-grid below:

14
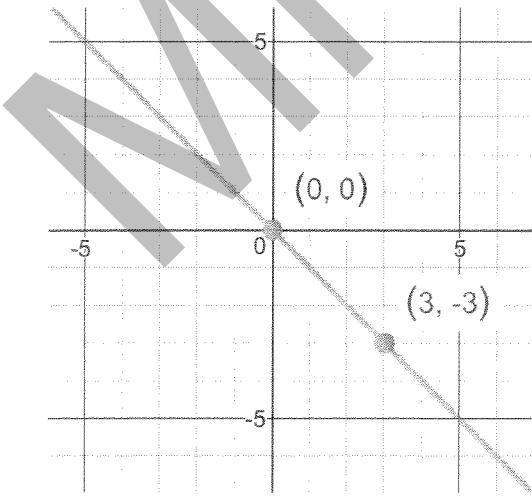
Equation of a line

1. Find the slope, the y-intercept, and write the equation of the lines below.
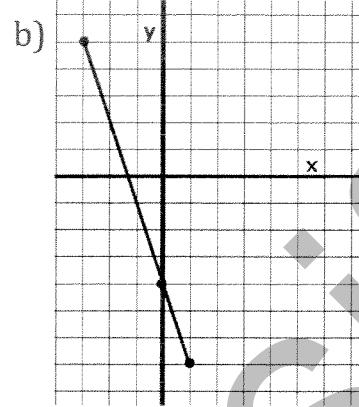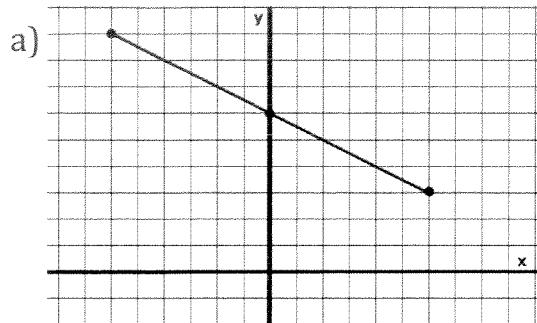
a)

a = _____

b = _____

Equation: _____

b)

a = _____

b = _____

Equation: _____

c)

a = _____

b = _____

Equation: _____

d)

a = _____

b = _____

Equation: _____

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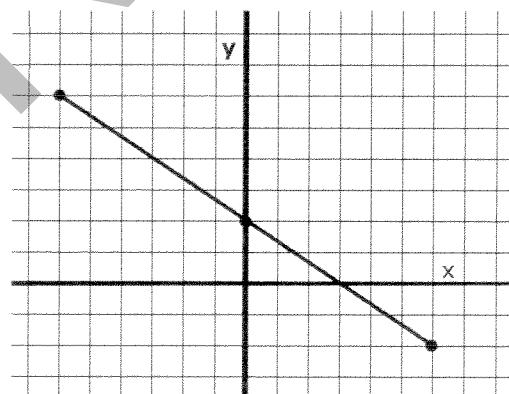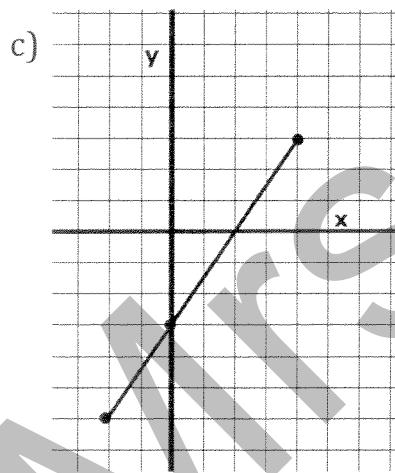
y intercept is known

Write the equation (y = ax + b) for each line.

1)
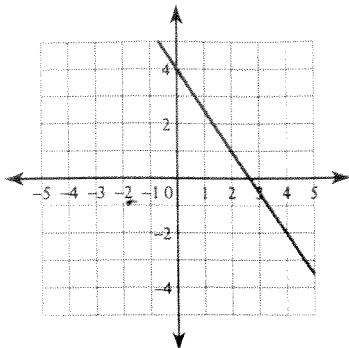
2)
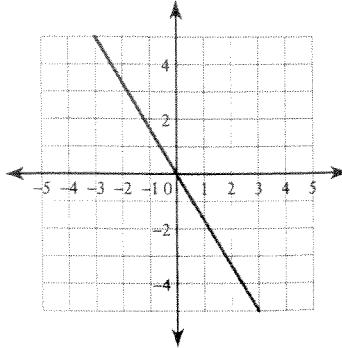
3)
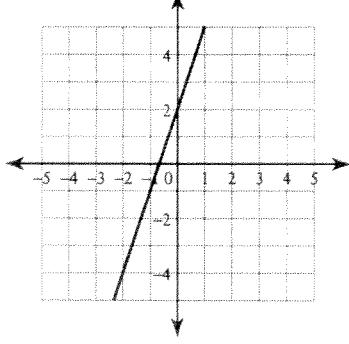
4)
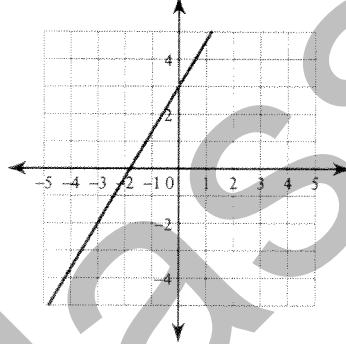
5)
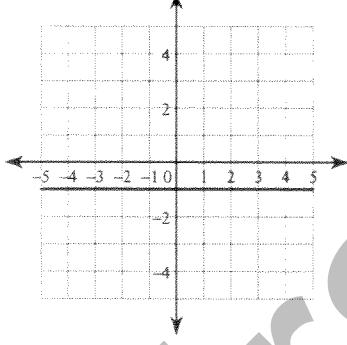
6)
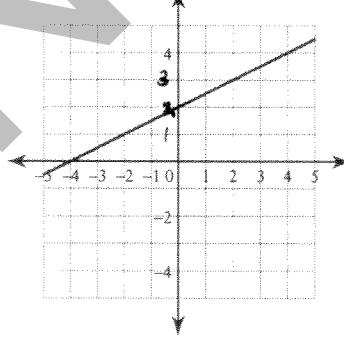
7)
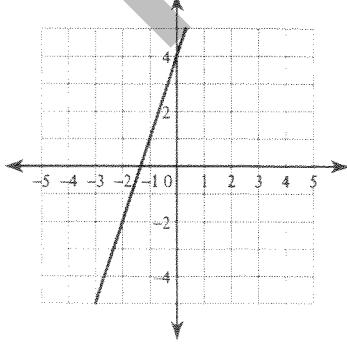
8)
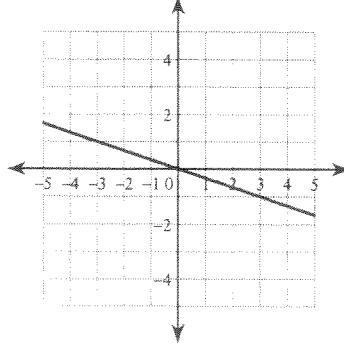
Write the rule for each line.

1)

2)

3)

4)

5)

6)

17

7)

8)

9)

10)

11)

12)

-2-

18
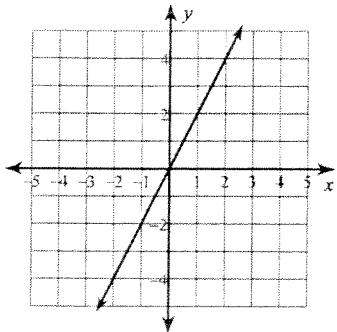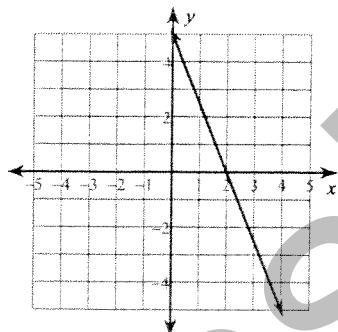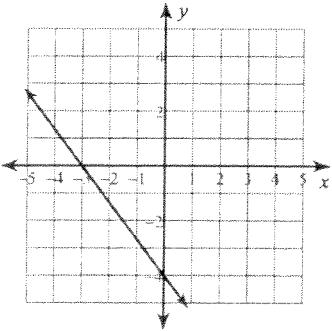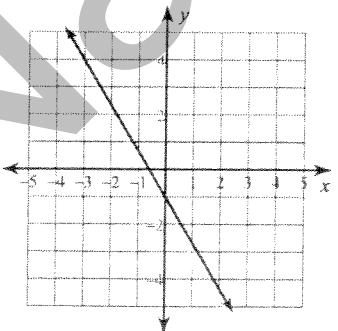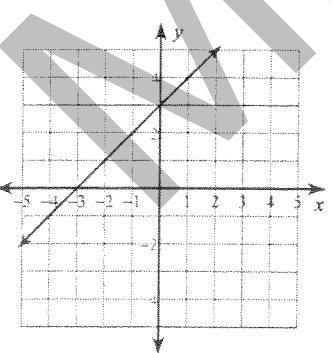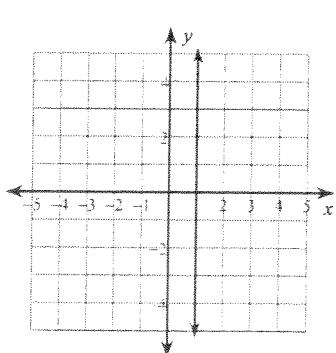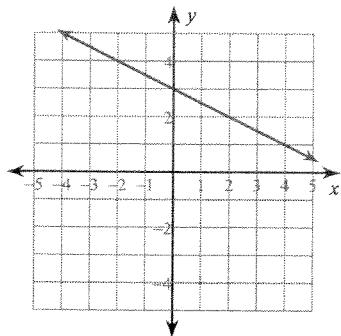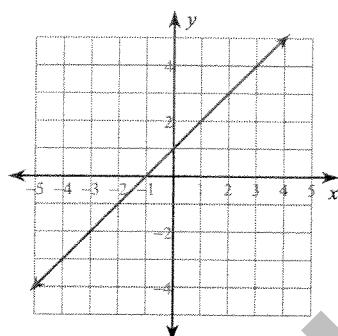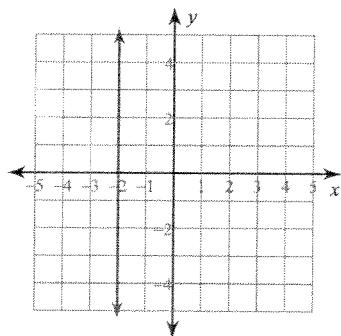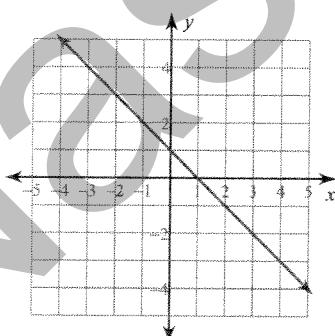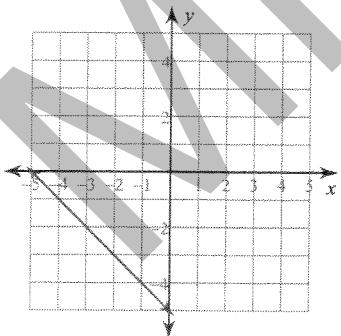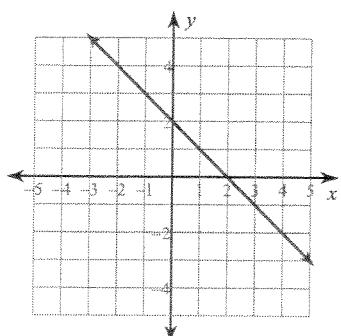
Y intercept is unknown

Find the equation of each line.

Do work in copybook.   (Scale = 1 unit)

1)

2)

3)

4)

5)

6)

7)

8)

9)

10)

11)

12)

20
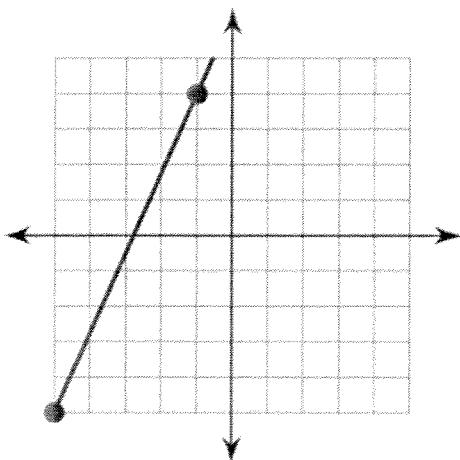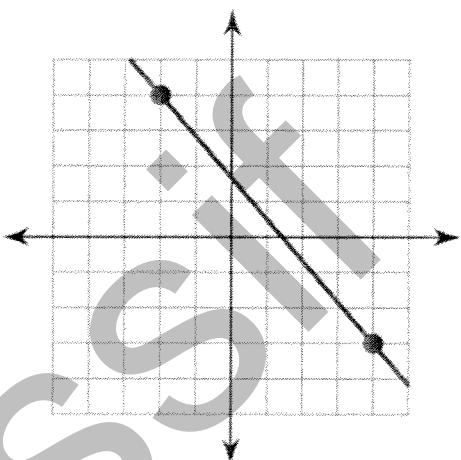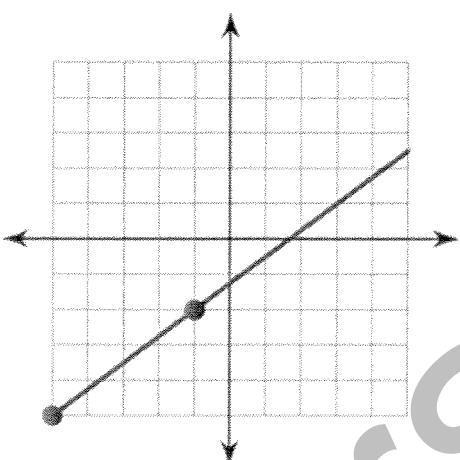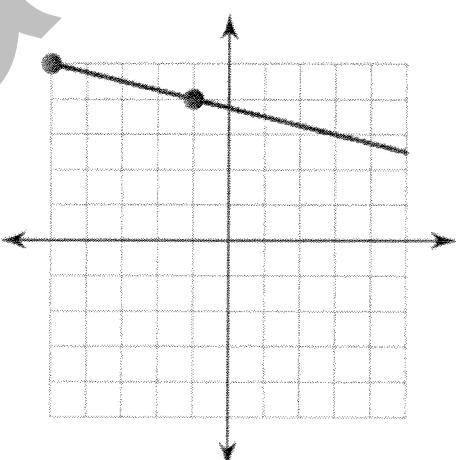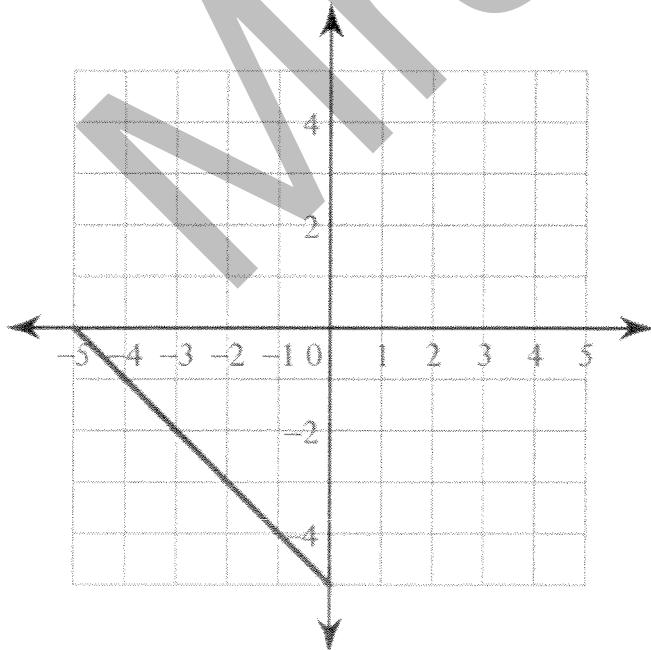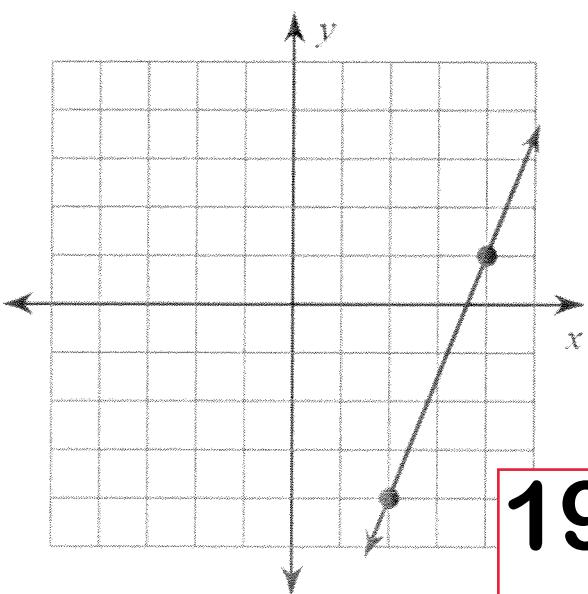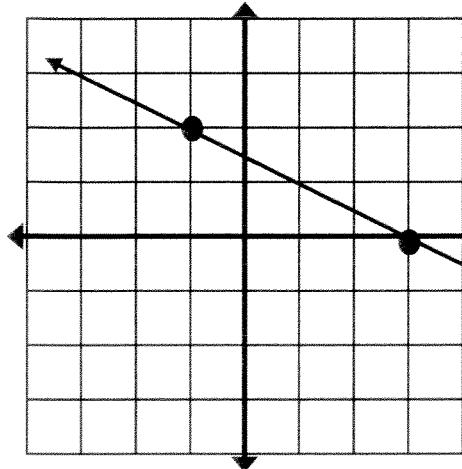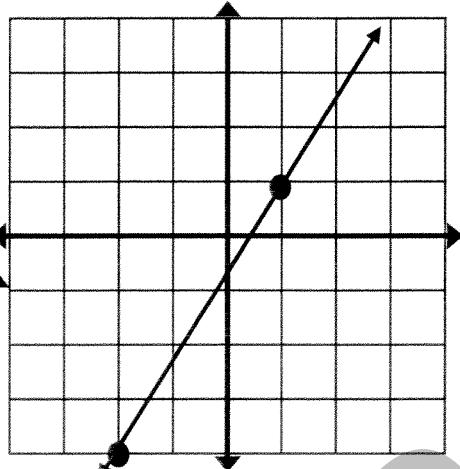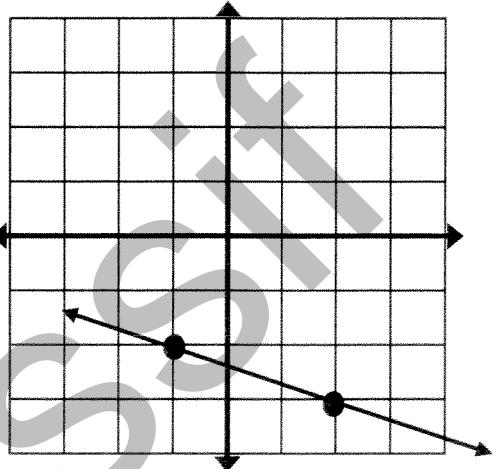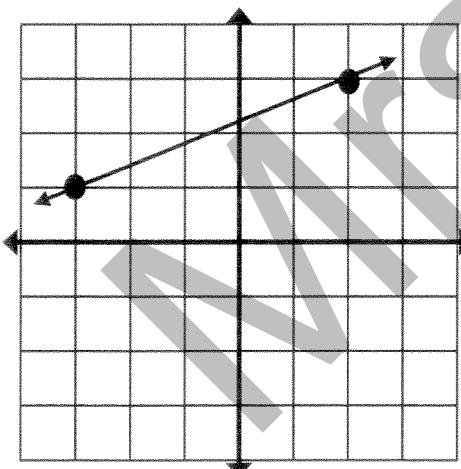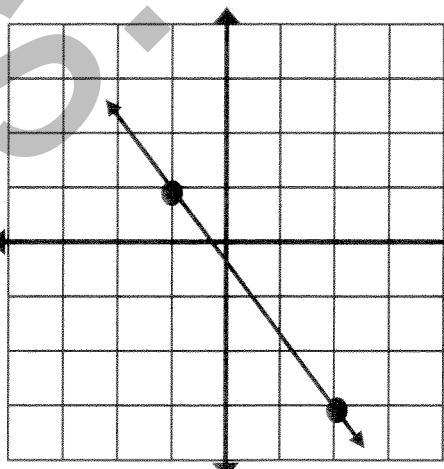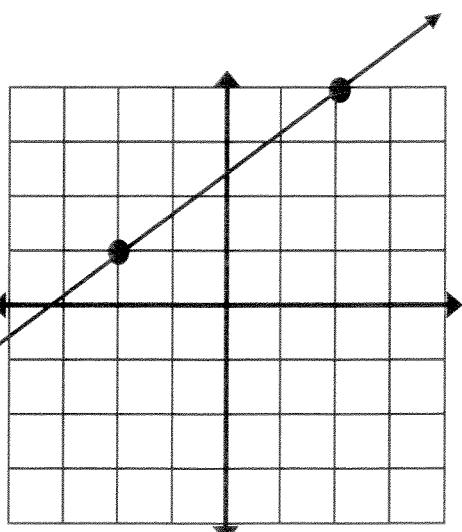
For questions 13-20, write the equation that is represented by the table.

13.

X	Y
-2	5
-1	4
0	3
1	2
2	1

Equation:

14.

X	Y
-2	1
-1	2
0	3
1	4
2	5

Equation:

15.

X	Y
-2	-5
-1	-3
0	-1
1	1
2	3

Equation:

16.

X	Y
-2	9
-1	6
0	3
1	0
2	-3

Equation:

17.

X	Y
-4	1
-2	4
0	7
2	10
4	13

Equation:

18.

X	Y
-10	5
-5	4
0	3
5	2
10	1

Equation:

19.

X	Y
-6	5
-3	3
0	1
3	-1
6	-3

Equation:

20.

X	Y
-4	-8
-2	-4
0	0
2	4
4	8

Equation:

21

Write the equation.

1. For each of the following questions:

- Write out **y = ax + b**
- Label the two given points **(x₁, y₁)** and **(x₂, y₂)**
- Calculate the slope **(a)** from these two points, using $a = \frac{y_2 - y_1}{x_2 - x_1}$
- Plug either set of coordinates **(x₁, y₁)** or **(x₂, y₂)** into the **y = ax + b** equation, along with the number you just calculated for **a**
- Solve for **b**
- Rewrite the **y = ax + b** equation with the values you found for **a** and **b**

a) (-4, -5) and (12, 27)

Equation: _____

b) (-4, 9) and (2, -15)

Equation: _____

32

22

c) (12, 4.5) and (-18, -5.5)

d) (15, -11.5) and (-3, 0.5)

Equation: _____

e) (2, 21) and (-3, 0.5)

Equation: _____

Equation: _____

23

LINEAR EQUATIONS: Complete the table below.

Reminder: write the slope without the variable x.

GENERAL FORM	FUNCTIONAL FORM	SLOPE	Y-INTERCEPT
$4x - 5y + 10 = 0$			
$3x + 6y - 54 = 0$			
$2x - y = 0$			
$2x - y + 3 = 0$			
$30x + 60y - 120 = 0$			
$20x + 50y - 100 = 0$			
$4x - y + 5 = 0$			
$y - 8 = 0$			
$4x - 2y + 5 = 0$			
$2y - 18 = 0$			

24

3. Find the slope (a) and y-intercept (b) of each line below.

a) $y = -5x - 1$

a = _____

b = _____

b) $y = 13x - 4$

a = _____

b = _____

c) $y = -15x - 4$

a = _____

b = _____

d) $x = 1$

a = _____

b = _____

e) $y = 14x + 1$

a = _____

b = _____

f) $y = -23x - 1$

a = _____

b = _____

g) $5y = -10x + 20$

a = _____

b = _____

h) $2y = -2x - 10$

a = _____

b = _____

i) $2x + 3y = 9$

a = _____

b = _____

25

LINEAR EQUATIONS

Graph each equation on the Cartesian plane.
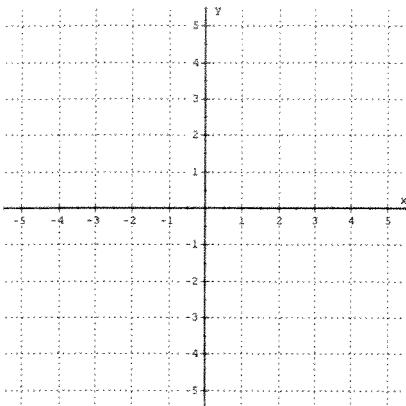
1) $y = 2x$
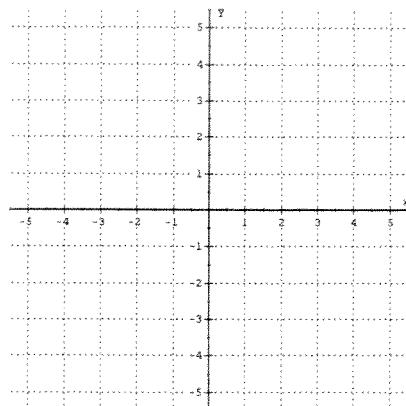
2) $y = -5x$
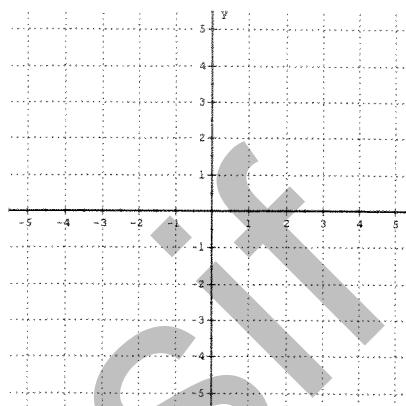
3) $y = \dfrac{2}{5}x$
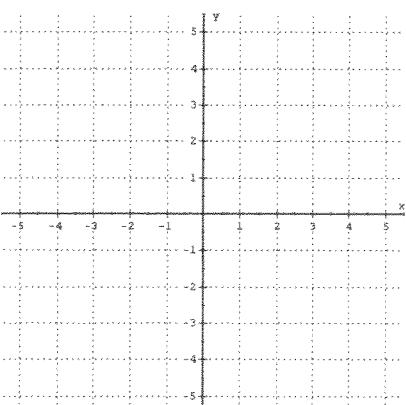
4) $y = x + 2$
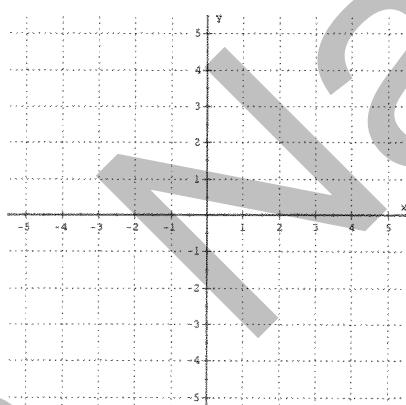
5) $y = x - 3$
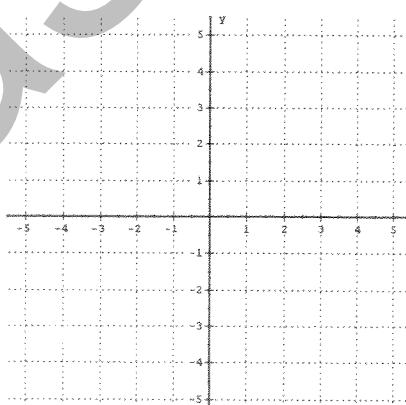
6) $y = 2x - 1$
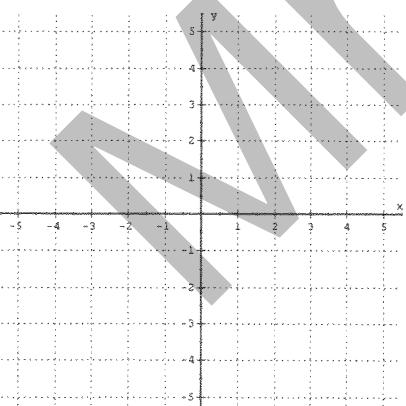
7) $y = -4x + 1$

8) $y = \dfrac{1}{2}x - 2$

9) $y = -\dfrac{5}{2}x + 3$

26
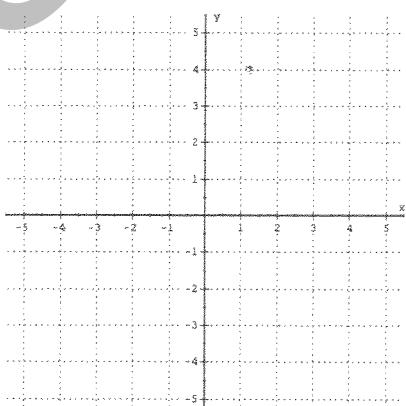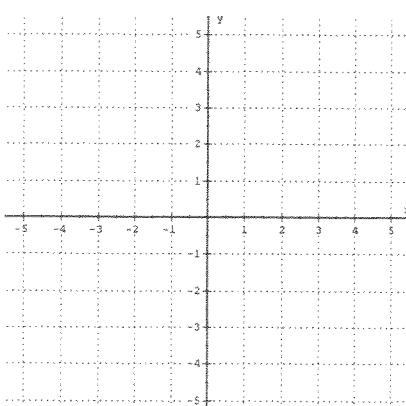
Graph each equation.

1) $x + 2y = 6$
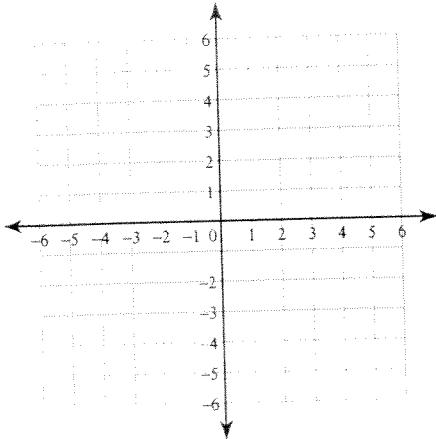
2) $3x + 2y = -8$
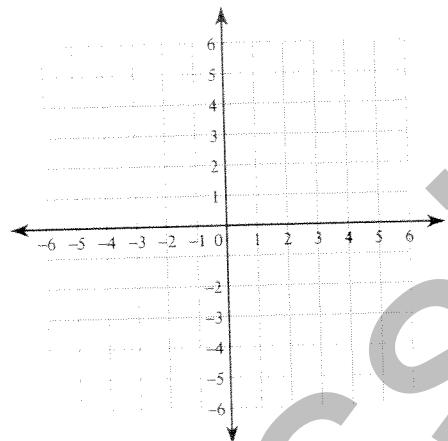
3) $x - 3y = 0$
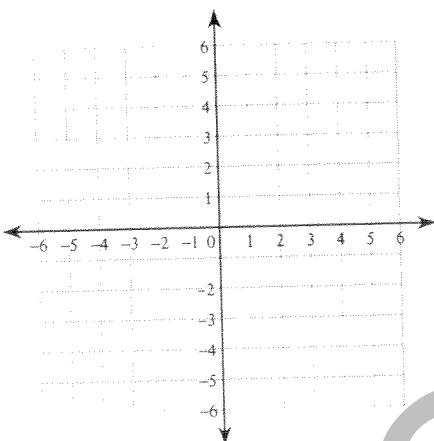
4) $x + 5y = 25$

5) $4x - y = 3$

6) $3x + 2y = 8$

27
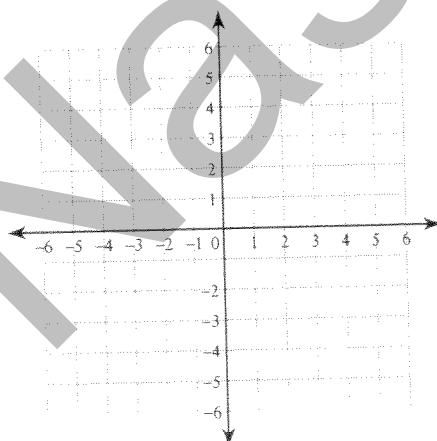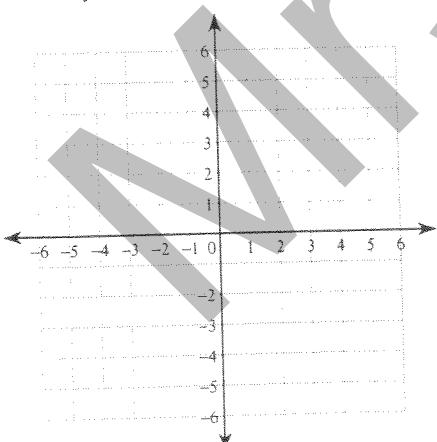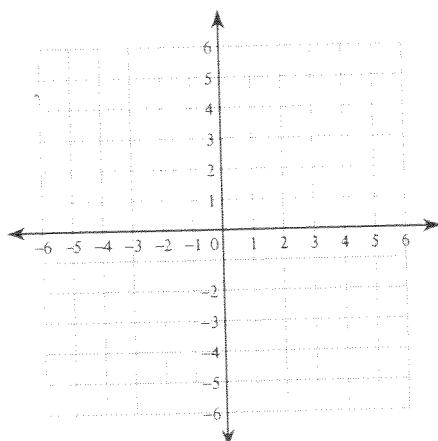
7) $x + 2y = -4$
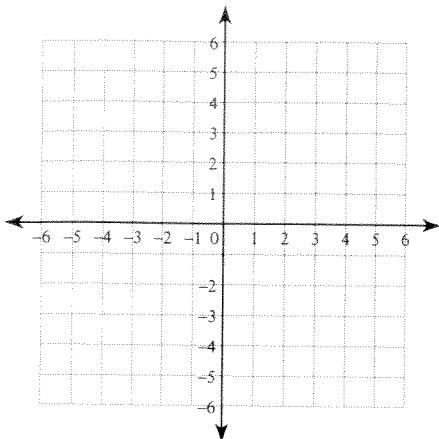
8) $y = 1$
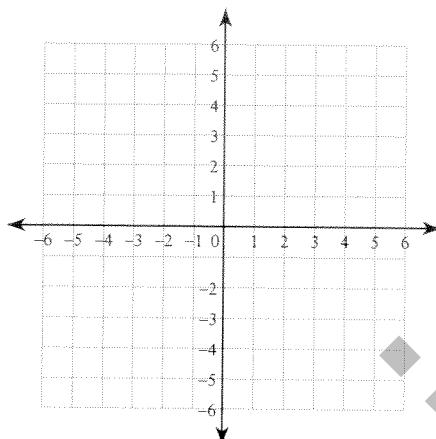
9) $2x + y = -5$
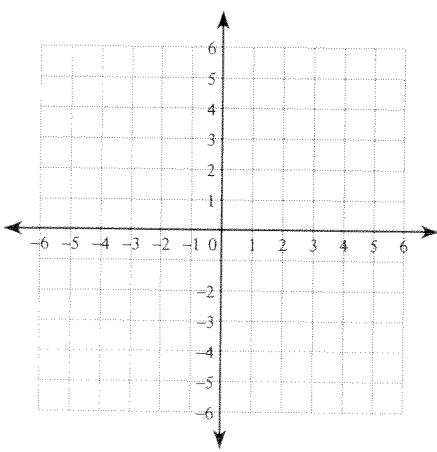
10) $x + y = -2$

11) $4x + 3y = 0$

12) $2x + y = -4$

28
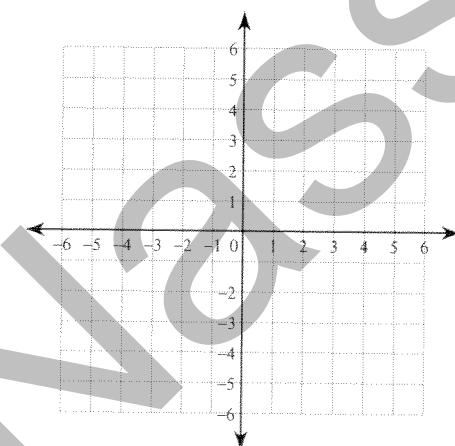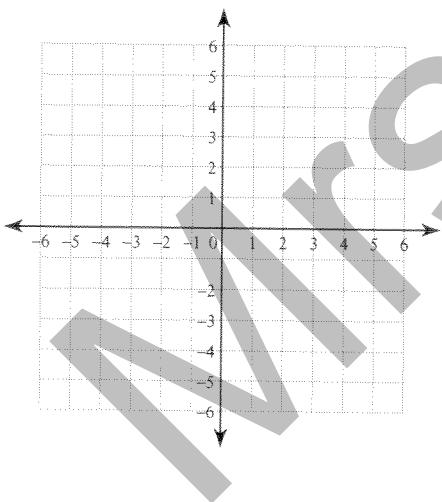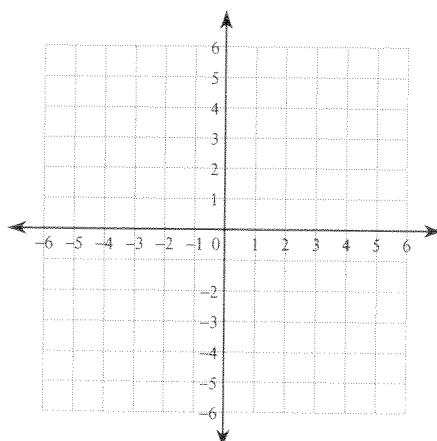
Graph each equation below.

① $y = -2$
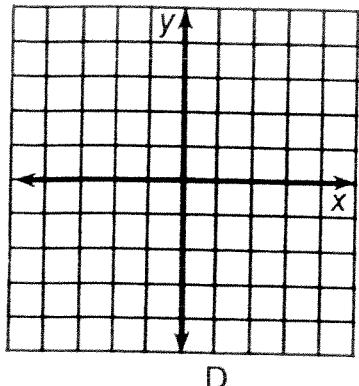
① $x = 4$
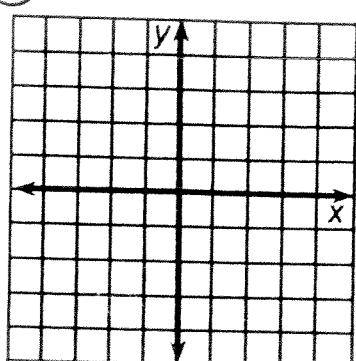
③ $2x - 3y = 9$
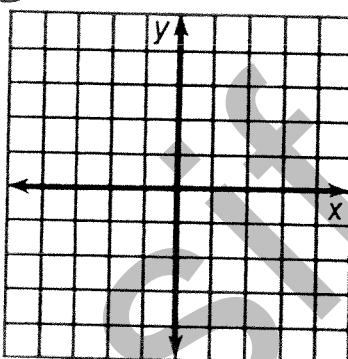
④ $x + 2y - 4 = 0$
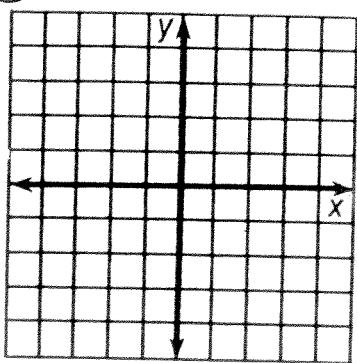
⑤ $3x + 4y = 12$
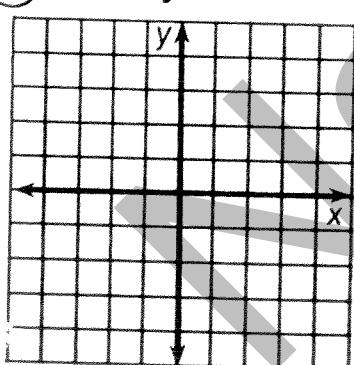
⑥ $6x - 5y + 20 = 0$
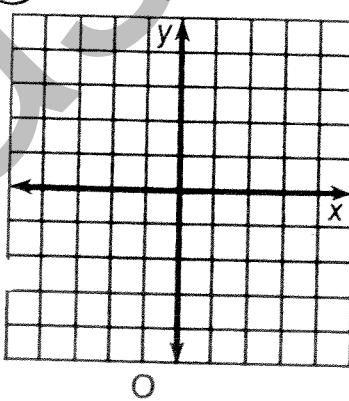
⑦ $x + 3 = 0$
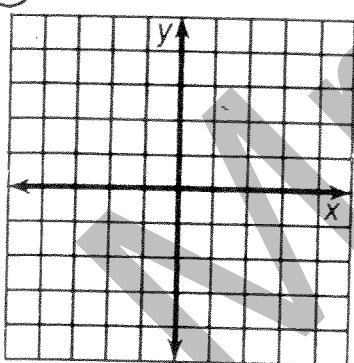
⑧ $2x - 7 = 0$
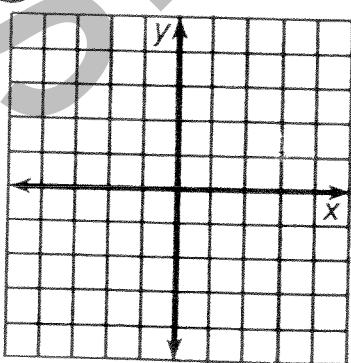
⑨ $-2x = 2y + 5$
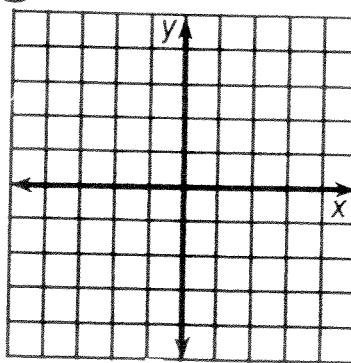
LINEAR EQUATIONS:

Use your copybook.

Calculate the x and y intercepts by plugging in 0.

1.) $3y + 2x = 9$
2.) $4x - 8 = 2y$
3.) $-3x - 10 = 2y$
4.) $5x + 6y = 30$
5.) $2x - y = 1$
6.) $x + 2y = -8$
7.) $8x + 3y = -9$
8.) $4x + 5y = -10$
9.) $x - y = -2$
10.) $4x - 3y = 9$
11.) $3x + 2y = 6$
12.) $4x - 5y = 0$
13.) $y = -1 + 2y$
14.) $x + 5y = -15$
15.) $-2y - 10 + 2x = 0$
16.) $x + 5 + y = 0$
17.) $3x + 20 = -4y$
18.) $-15 - x = -5y$
19.) $-1 = -2x + 2y$
20.) $-x - 1 = y + 3$
21.) $0 = 5y - x$
22.) $-30 + 10y = -2x$
23.) $-30 + 10y = -5y$

Write the coordinates of the x and y intercepts: (0, y) (x,0)

1. $4x + y = 5$

2. $x - y = 1$

3. $x + 4y = 8$

4. $5x + y = 2$

5. $7x + 3y = -21$

6. $3x + 6y = 18$

7. $4x + y = -8$

8. $x - 2y = -10$

9. $6x + 4y = 12$

10. $x - 9y = -45$

11. $2x - 6y = 18$

12. $7x + 5y = 42$

X and Y Intercepts Worksheet

Identify the x and y intercepts and write as an ordered pair

1.
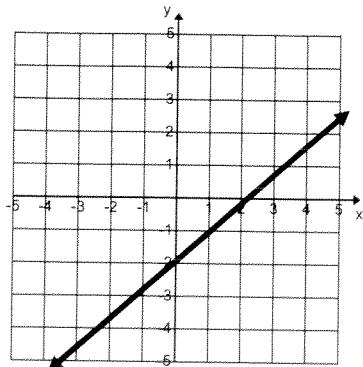
Answer:
(0, -2) &
(2,0)

2.
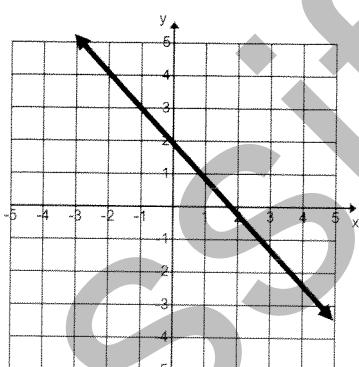
3.
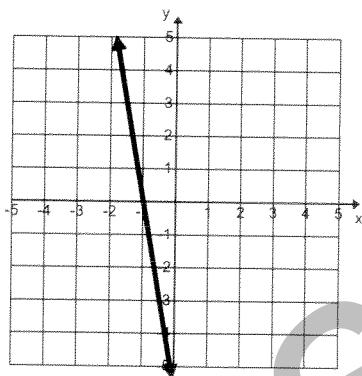
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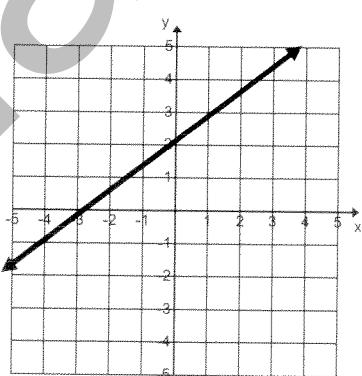
5.
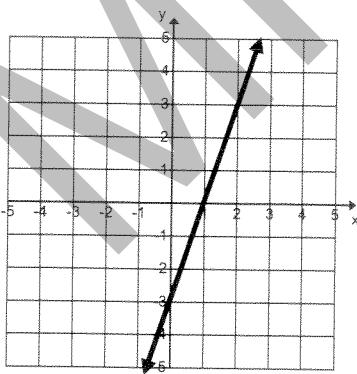
6.
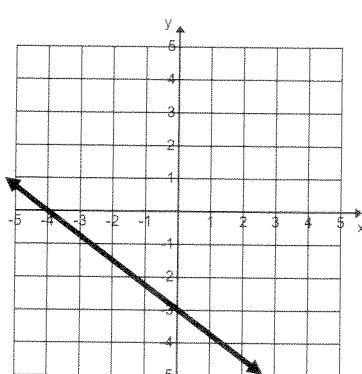
X AND Y- INTERCEPTS

Graph the following equations by plotting the x and y-intercepts and then drawing the line through the 2 points.

1. x + y = 8
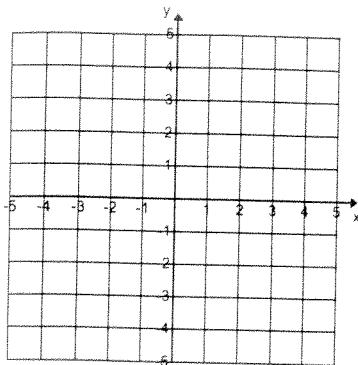
2. 2x + 3y = 12
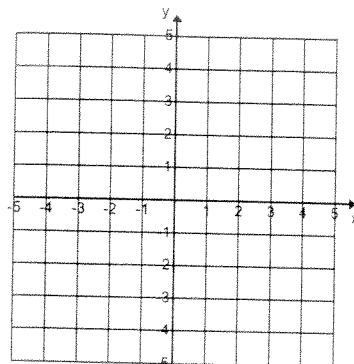
3. 6x + 4y = 12
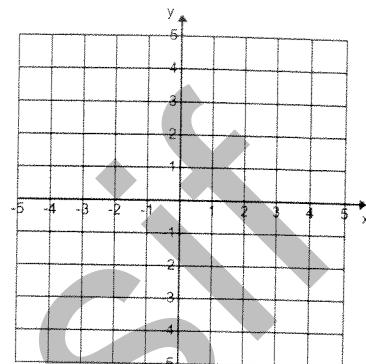
4. 4x + y = – 8
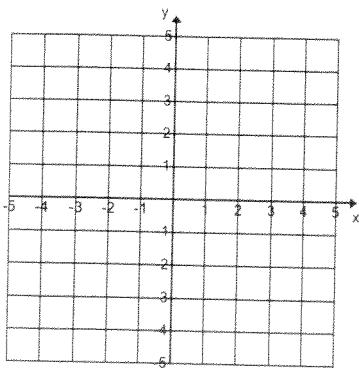
5. 5x – 2y = – 10
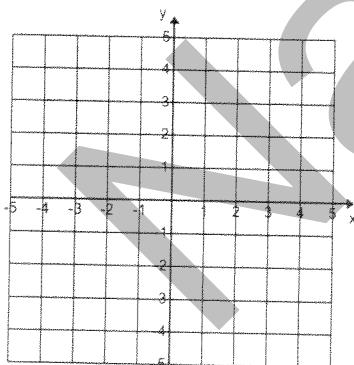
6. x - 4y = 16
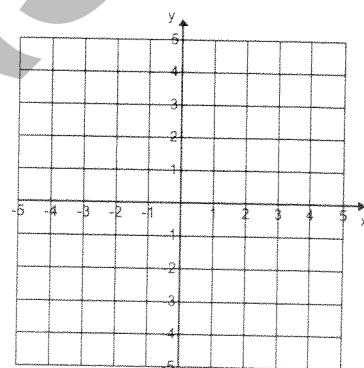
7. -3x - 9y = –18
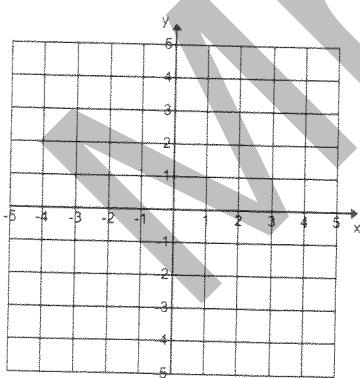
8. 7x – 2y = –14

9. -10x + 15y = 60

33
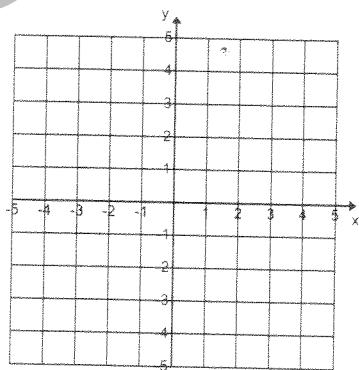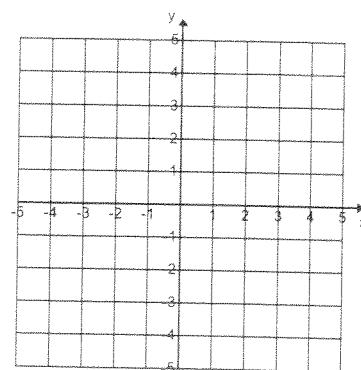
Sketch the line given the description provided.

a) a positive slope and a
   positive y-intercept (ex: y = ax + b)
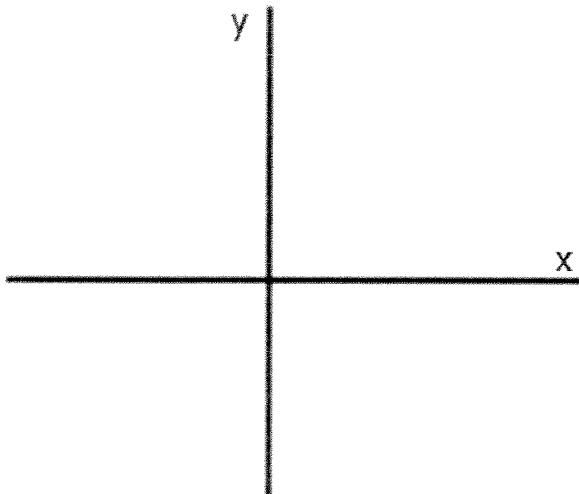
b) a negative slope and a
   positive y-intercept (ex: y = −ax + b)
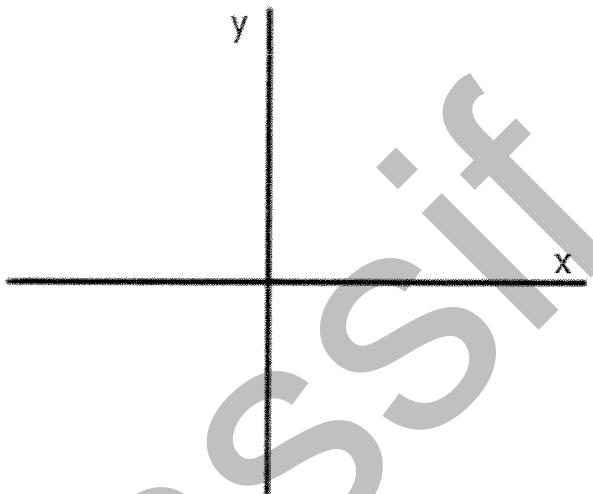
c) a positive slope and a
   negative y-intercept (ex: y = ax − b)
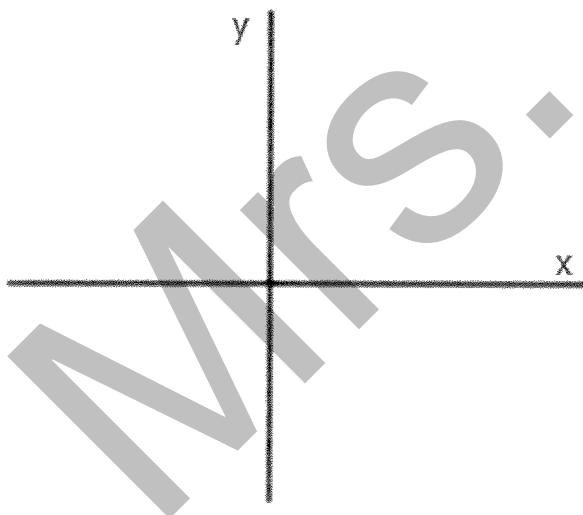
d) a negative slope and a
   negative y-intercept (ex: y = −ax − b)

34
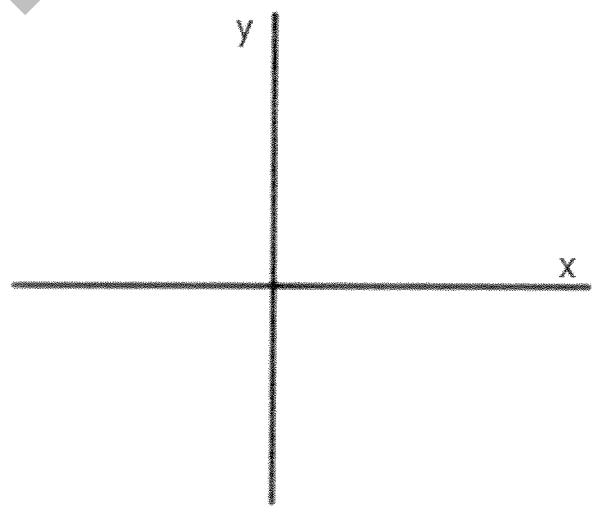
4. For each of the following equations:
- identify the slope (a) and y-intercept (b).
- sketch the y-intercept on the graph.
- show the direction of the slope.

a) y = −7x + 3

a = _____

b = _____

b) y = 6x − 4

a = _____

b = _____

c) y = 40x − 300

a = _____

b = _____

d) 4y = 12x - 20

e) −3y = 15x − 36

f) 4.5y = 18x − 27

a = _____

b = _____

a = _____

b = _____

a = _____

b = _____

35
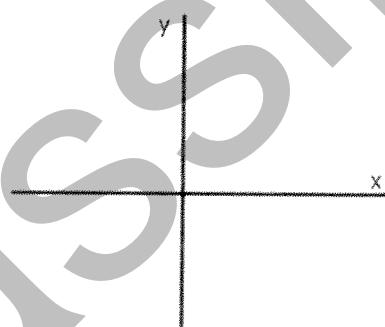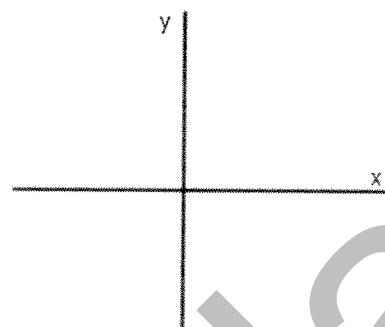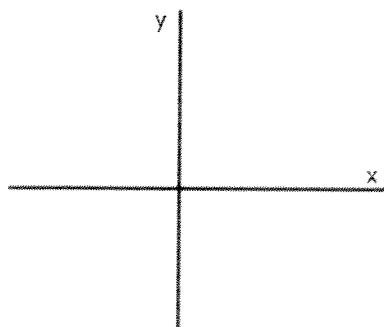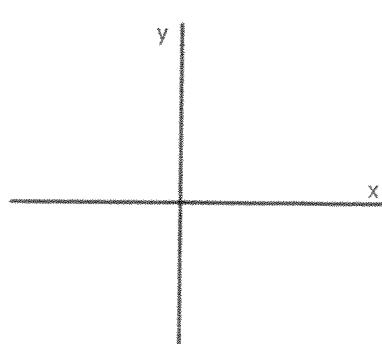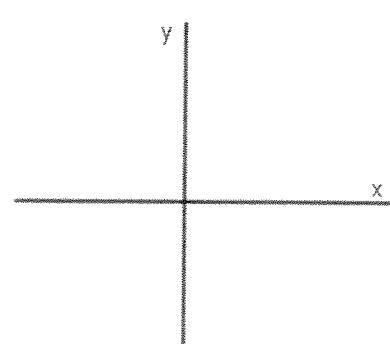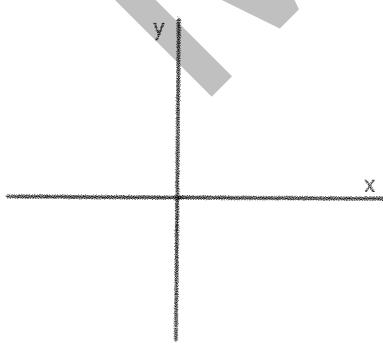
g) $5y - 30 = 45x$

h) $12y + 60 = -48x$

i) $-3y + 24 = 72x$

a = _____

b = _____

a = _____

b = _____

a = _____

b = _____
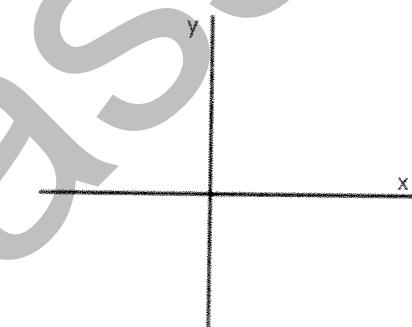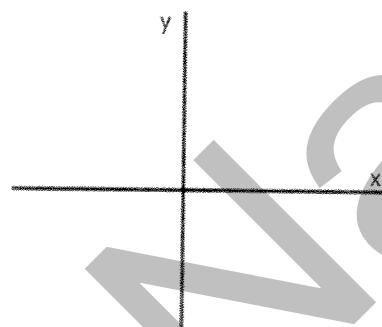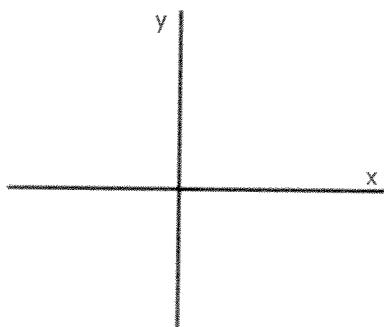
Sketch the line.

d) $3y = 12x - 30$

e) $-5y = 45x - 80$

f) $3.5y = 49x + 28$

a = _____

b = _____
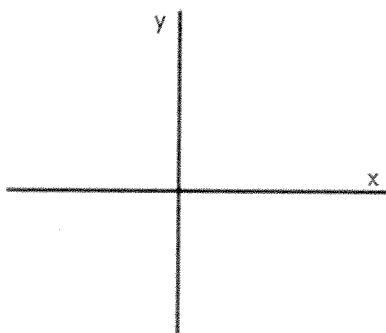
a = _____

b = _____
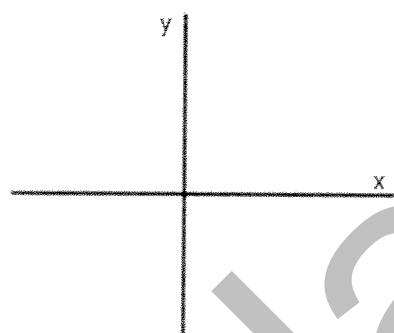
a = _____

b = _____
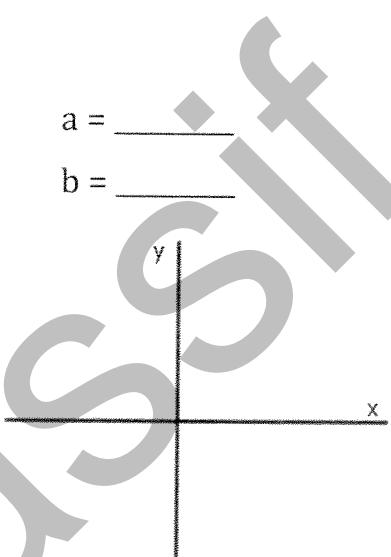
g) $2y - 50 = 16x$

h) $4y + 60 = 48x$

i) $-6y + 24 = 72x$

a = _____

b = _____

a = _____

b = _____

a = _____

b = _____

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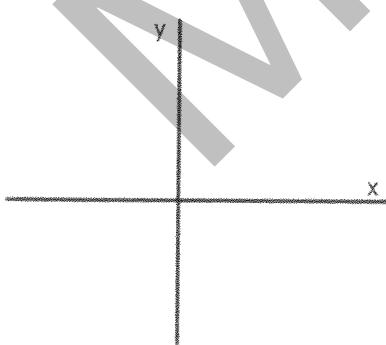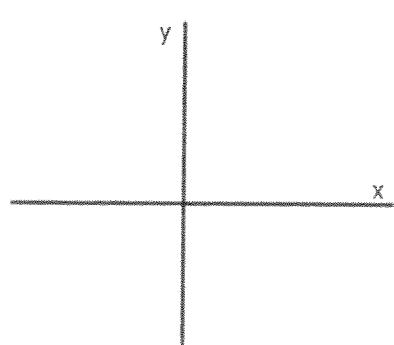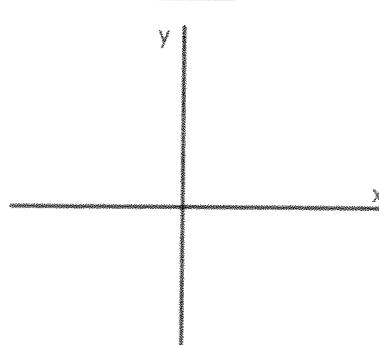
d) $-5y = 10x + 15$

e) $-3y = -6x + 18$

f) $-8y = 72x - 108$

a = _____

b = _____
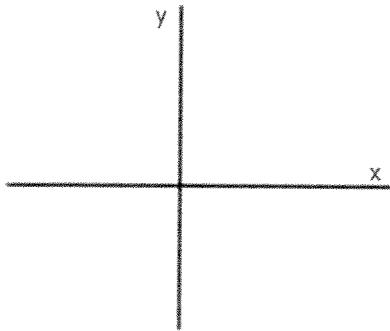
a = _____

b = _____
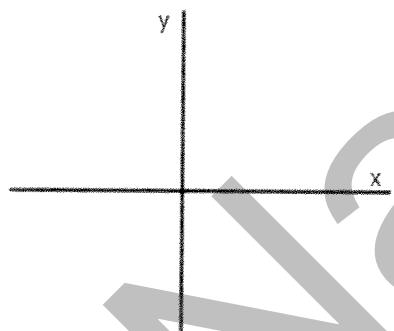
a = _____

b = _____
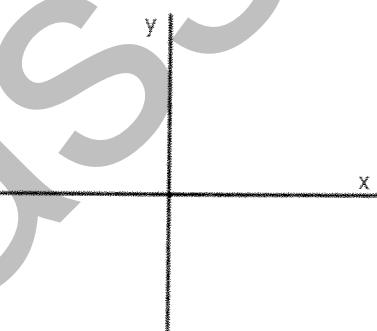
g) $6x + 2y = 30$

h) $9x - 4.5y = -36$

i) $3y + 51 = 18x$

a = _____

b = _____

a = _____

b = _____

a = _____

b = _____

page

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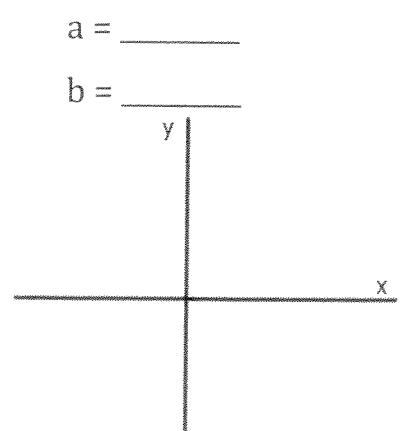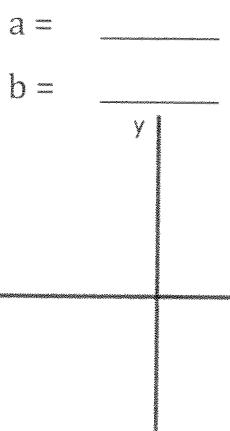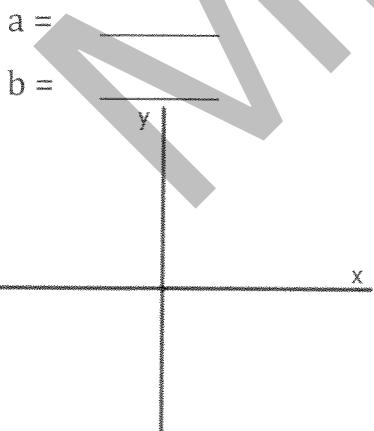
Write the equation given a description.

1. What is the equation of a line with a **slope of** $\frac{2}{5}$ and a **y-intercept of -2**?
   (Sketch the graph)
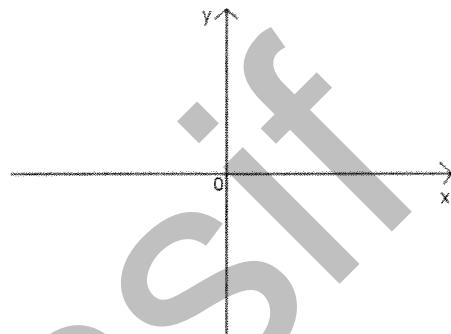
Equation: _____

2. What is the equation of a line with a **slope of -5** and an **x-intercept of 17** ?
   (Sketch the graph)
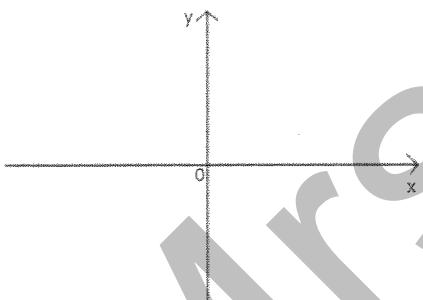
Equation: _____

3. What is the equation of a line with an **x-intercept of 6** and a **y-intercept of -3**? (Sketch the graph)
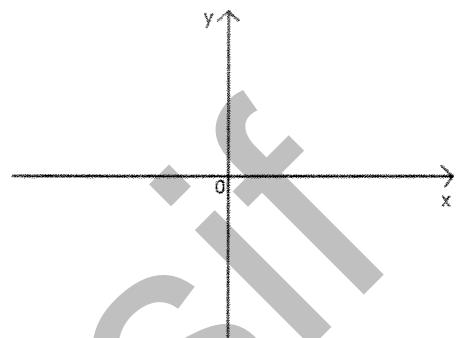
Equation: _____

4. What is the equation of a line with an **x-intercept of 8** and a **y-intercept of 16**? (Sketch the graph)
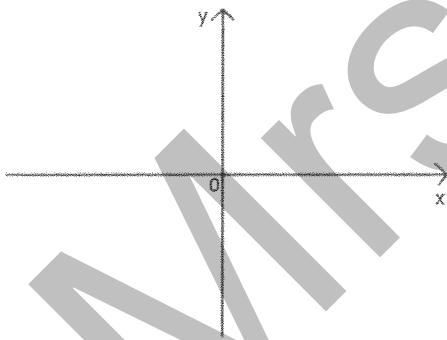
Equation: _____

5. What is the **y-intercept** of a line passing through **(-12, -8)** and **(36, 4)?**
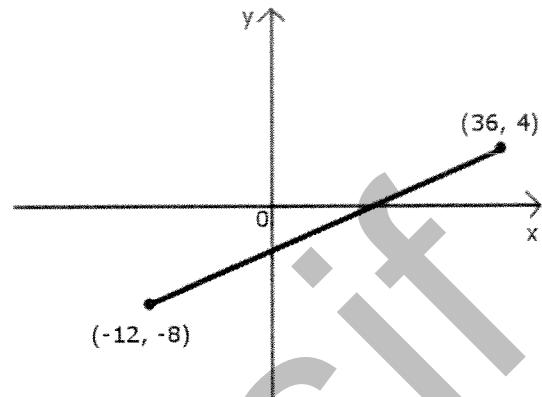
Y-intercept: (0 , _____)

6. What is the **x-intercept** of a line passing through **(-12, -8)** and **(36, 4)?**

X-intercept: (_____ , 0)

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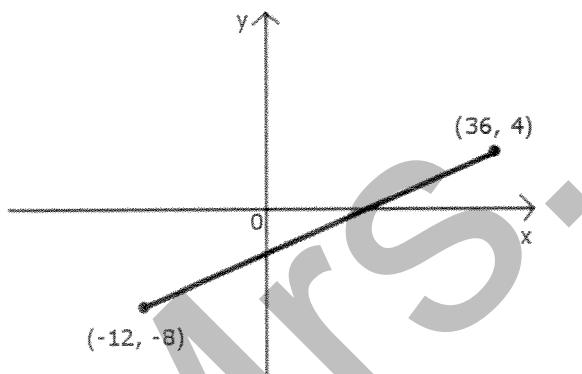
7. What is the **y-intercept** of a line passing through **(-24, 16)** and **(18, 2)**?

(-24, 16)

(18, 2)
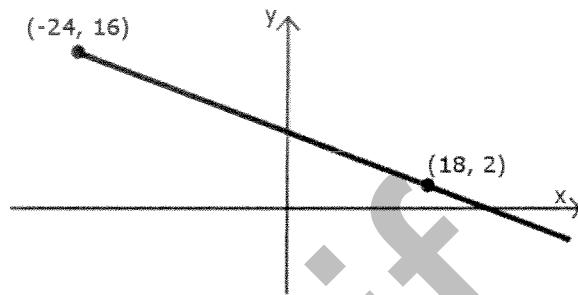
Y-intercept: (0 , _____)

8. What is the **x-intercept** of a line passing through **(-24, 16)** and **(18, 2)**?
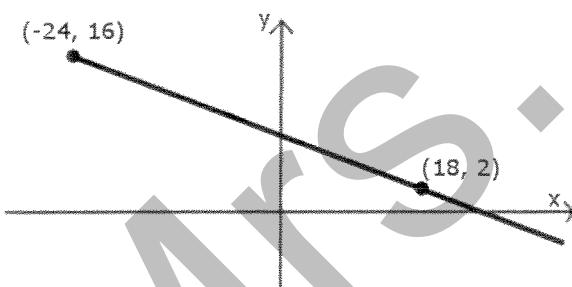
(-24, 16)

(18, 2)

X-intercept: (_____ , 0)

42

Write the equation given the description.

1. What is the equation of a line with a **slope of** $-\frac{1}{3}$ and a **y-intercept of 4**?
   (Sketch the graph)
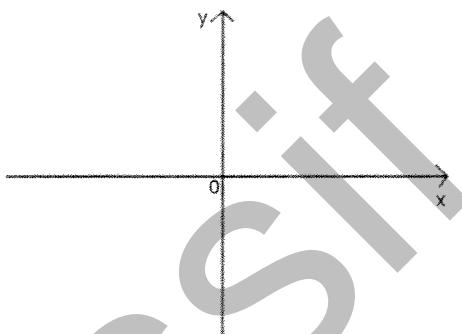
Equation: _____

2. What is the equation of a line with a **slope of 3** and an **x-intercept of 6**?
   (Sketch the graph)
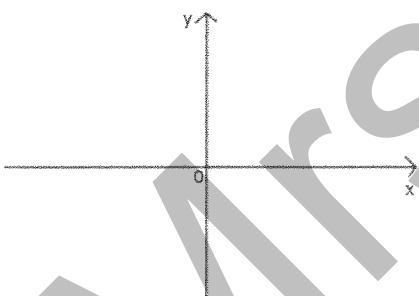
Equation: _____

3. What is the equation of a line with a **slope of** $\frac{2}{3}$ and an **x-intercept of -12**?

(Sketch the graph)
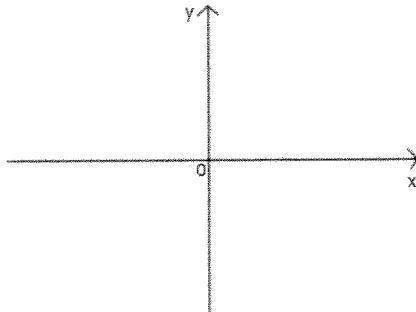
Equation: _____

4. What is the equation of a line with an **x-intercept of 16** and a **y-intercept of -2**?
(Sketch the graph)
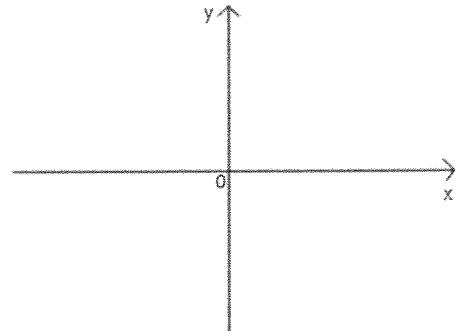
Equation: _____

5. What is the equation of a line with an **x-intercept of 9** and a **y-intercept of 6**? (Sketch the graph)
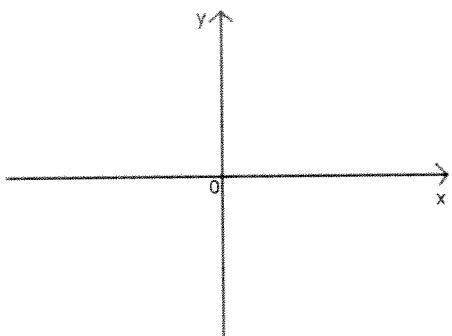

Equation: _____

6. What is the **x-intercept** of a line passing through **(-25, -33)** and **(15, -9)**?

(15 , -9)

(-25 , -33)

X-intercept: (_____ , 0)

page

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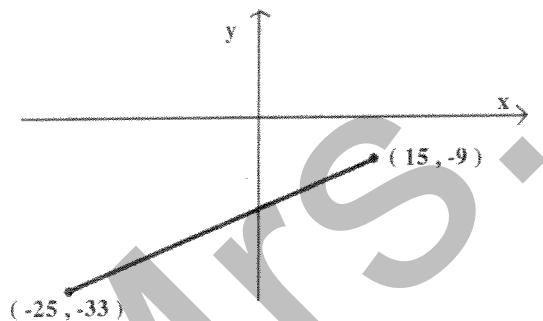
Visual Interpretation of Linear Equations
Answer the questions below.

1. What are the coordinates of point C?

$5y - 12.5x - 15 = 0$

C (_____ , _____)
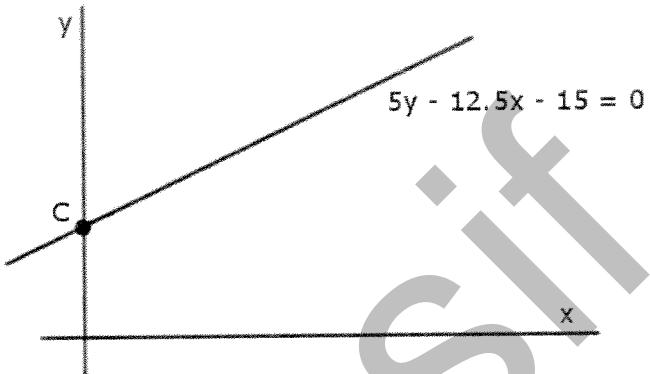
2. What are the coordinates of point B?

$4y - 2x - 14 = 0$

B (_____ , _____)
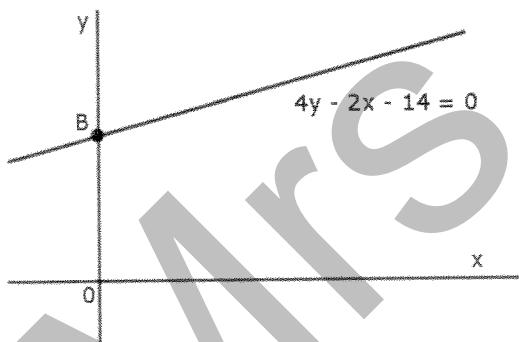
3. What are the coordinates of point A

$$6y + 1.5x - 48 = 0$$

A (_____ , _____)
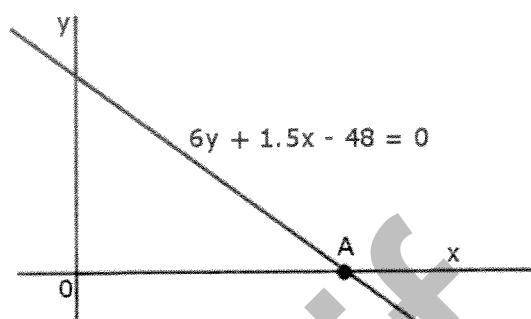
4. What are the coordinates of point D?

$$9y + 3x - 135 = 0$$

D (_____ , _____)
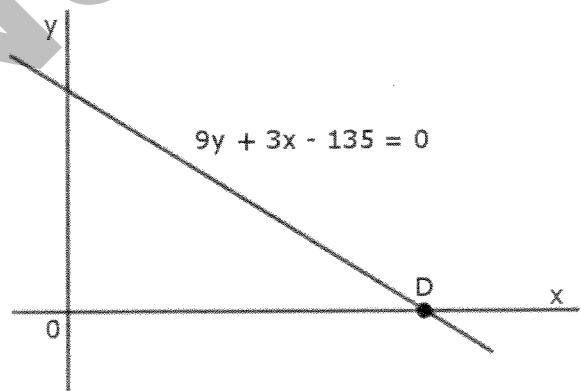
5. Find the value of the missing coordinate.
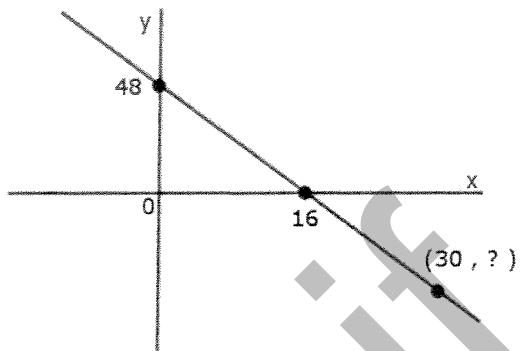
Answer (30 , _____)

**6.** Find the value of the missing coordinate.
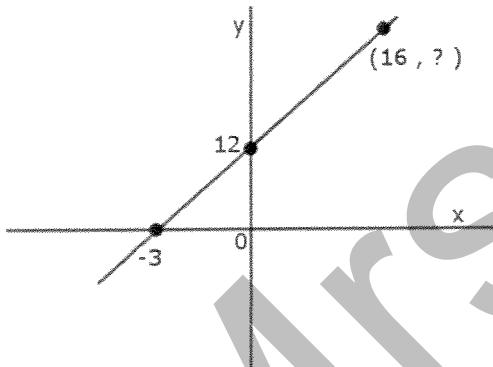
Answer (16 , _____)

7. What are the missing coordinates?

(-7, 225)

(3 , 75)

?
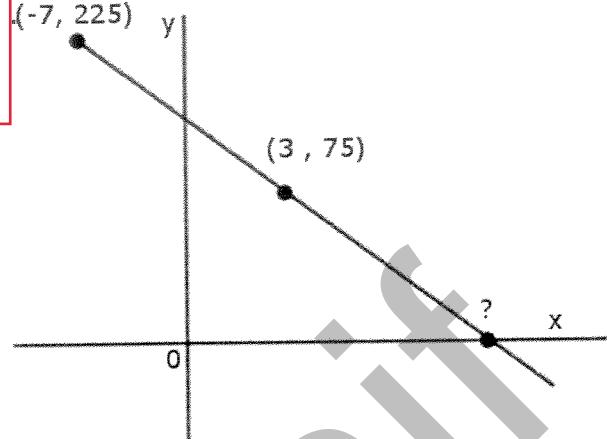
Answer (_____ , _____)

8. What are the missing coordinates?

(12, 31.5)

?

(-20, -8.5)
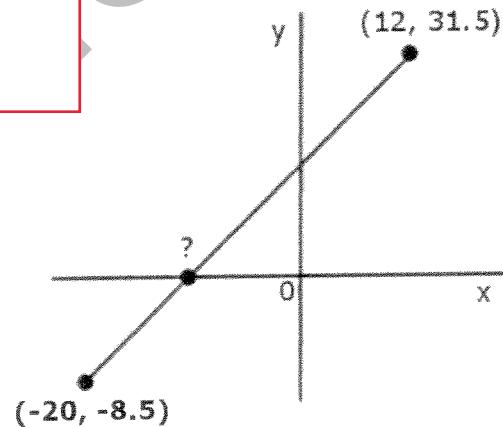
Answer (_____ , _____)

Write the equation given the description.

1. What is the equation of a line with a **slope of** $-\frac{2}{5}$ and a **y-intercept of 5**?

   Sketch the graph (1 pt)
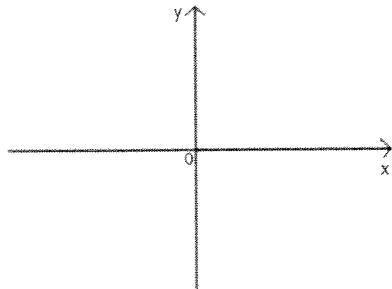
   Equation: _____

2. What is the equation of a line with a **slope of** $-\frac{2}{3}$ and an **x-intercept of 13**?

   Sketch the graph (1 pt)
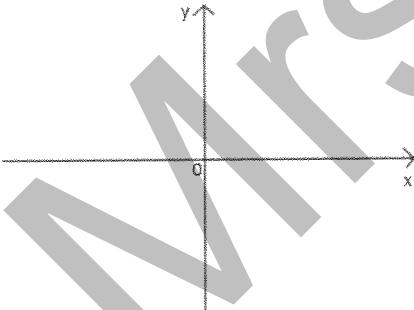
   Equation: _____

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3. What is the equation of a line with an **x-intercept of 16** and a **y-intercept of -2**?
   Sketch the graph (1 pt)
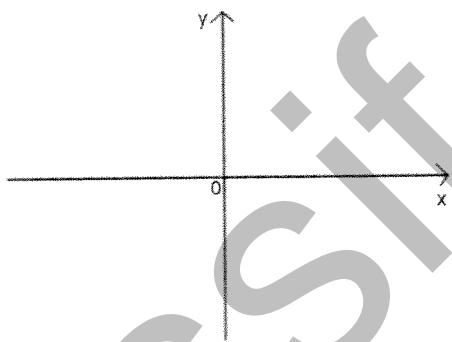
Equation: _____

4. What are the coordinates of point B?

$16y + 6x - 1008 = 0$

B (_____ , _____)

51
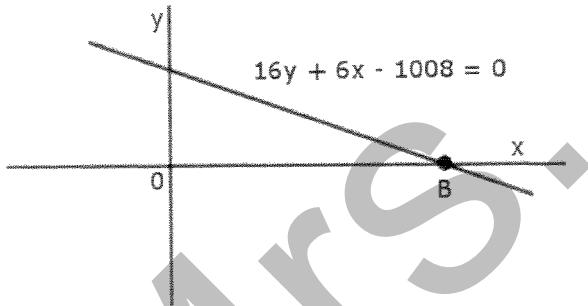
5. What is the **y-intercept** of a line passing through **(-512, 89)** and **(1024, -103)?**

(-512 , 89)

(1024 , -103)
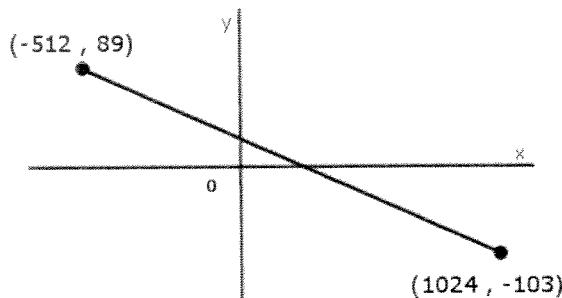
Y-intercept (_____ , _____)

6. What is the **x-intercept** of a line passing through **(1664, -24)** and **(-832, -180)?**

(1664, -24)

(-832 , -180)
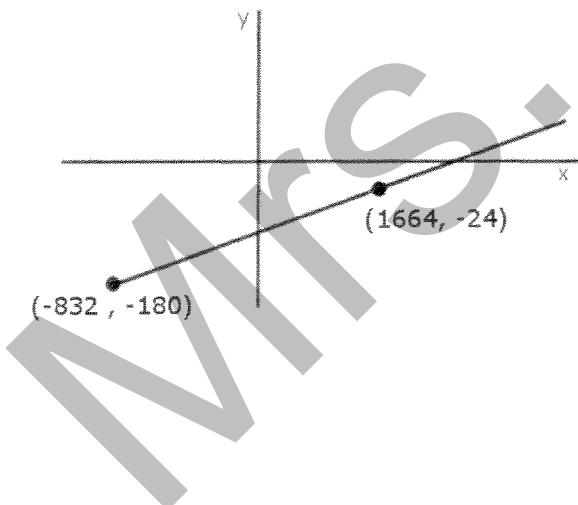
X-intercept (_____ , _____)

2. What is the equation of a line that has a y-intercept of (0, -6) and also passes through the point (14, 43)?

Equation: _____

3. What is the equation of a line that has a y-intercept of (0, −12) and also passes through the point (14, 44)?

Equation: _____

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4. What is the equation of a line that has a y-intercept of $(0, 8)$ and also passes through the point $(-6, 14)$?

Equation: _____

5. What is the equation of a line that has a y-intercept of $(0, -4)$ and also passes through the point $(-8, 0)$?

Equation: _____

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