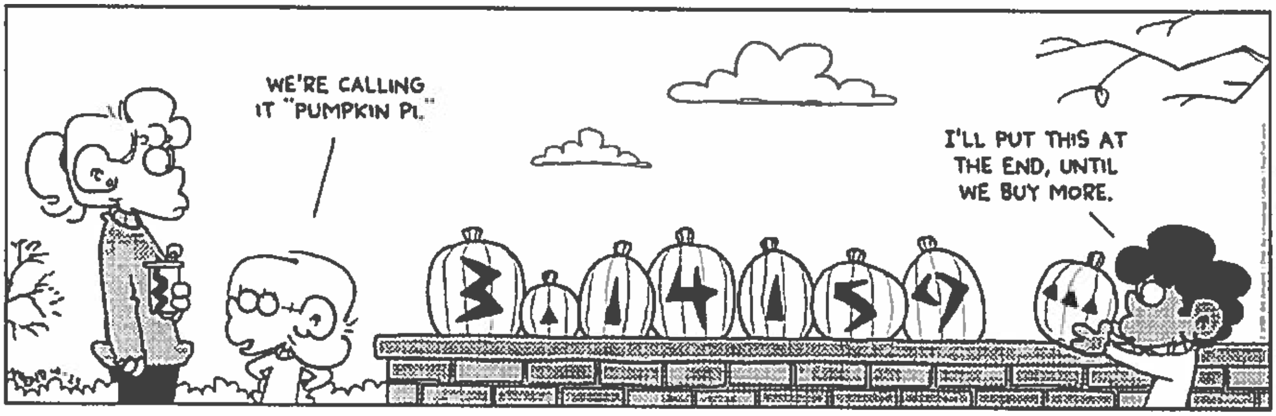
Name: ______________________________

Date: __________________

Chapter 3

Parallel
and
Perpendicular Lines



Sections Covered:

3.1 Identify Pairs of Lines and Angles

3.2 Use Parallel Lines and Transversals

3.3 Prove Lines are Parallel

3.4 Find and Use Slopes of Lines

3.5 Write and Graph Equations of Lines

Unit 3 Syllabus: Chapter 3 Parallel and Perpendicular Lines

Date	Topic	Homework
A 10/17 B 10/18	3.1 Identifying Lines and Angles 3.2 Angle Relationships and Parallel Lines	Worksheet: 3.1 and 3.2 Identifying Lines and Angle Relationships
A 10/19 B 10/20	3.3 Proving Lines Parallel	Worksheet: 3.3 Proving Lines Parallel
A 10/24 B 10/25	3.1-3.3 Quiz Review	Review Worksheet #1
10/26-10/31	Testing Window Schedule 10/26: Blocks 1-4 Quiz 3.1-3.3 10/27: Blocks 5/7 Quiz Block 8: Project 10/30: Blocks 1-4 Project 10/31: Blocks 5/7: Project Block 8: Quiz	Problem Set #4
A 11/1 B 11/2	3.4 Slopes of Lines 3.5 Writing Equations of Lines	Worksheet: 3.4 and 3.5 Find and Use Slopes of Lines and Equations of a line
A 11/3 B 11/8	Review Day Chapter 3	Review Worksheet #2
A 11/9 B 11/10	Review Day #2 Chapter 3	TBD
A 11/13 B 11/14	Chapter 3 Test	Problem Set #5

***Syllabus subject to change due to weather, pep rallies, illness, etc.

Need Help?
Email your teacher to set up a time before or after school!
Peer Tutoring is available through Mu Alpha Theta is Monday, Tuesday, Thursday, and Friday mornings in L400.

Need to make up a test/quiz?
Math Make Up Room is open Tuesday and Thursday mornings and Wednesday afternoon.

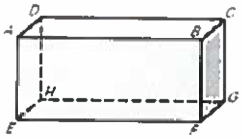
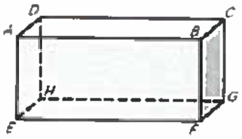
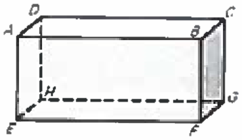
3.1-3.2 Identify Pair of Lines and Angles

These notes we will…

Explore how lines relate in space.

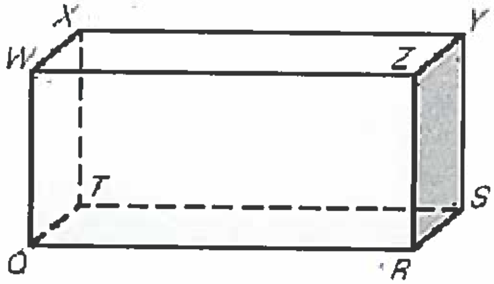
So that we can…

Identify angle pairs formed by three intersecting lines.

Term	Definition	Example
Parallel Lines Symbol: ∥	Two lines in a plane that never intersect.	 $\overleftrightarrow{DC} \parallel \overleftrightarrow{AB}$ $\overleftrightarrow{BF} \parallel \overleftrightarrow{CG}$
Skew Lines	Two lines that do not intersect and are not in the same plane.	 $\overleftrightarrow{DC}$ ∤ $\overleftrightarrow{FG}$ $\overrightarrow{EH}$ ∤ $\overleftrightarrow{AB}$
symbol: ⊥ **Perpendicular Lines**	Two lines that intersect to form a right angle.	 $\overleftrightarrow{AD} \perp \overleftrightarrow{AB}$ $\overleftrightarrow{HG} \perp \overleftrightarrow{DH}$

Use the diagram to identify the lines as *parallel, perpendicular* or *skew*.

1. $\overleftrightarrow{WZ}$ and $\overleftrightarrow{XY}$ are parallel
2. $\overleftrightarrow{WZ}$ and $\overleftrightarrow{QW}$ are perpendicular
3. $\overleftrightarrow{SY}$ and $\overleftrightarrow{WX}$ are skew
4. Plane WQR and plane SYT are parallel
5. Plane RZS and plane WQR are perpendicular



Think of each segment in the diagram as part of a line. Which line(s) or plane(s) appear to fit the description?

6. Line(s) parallel to $\overleftrightarrow{AB}$

   $\overleftrightarrow{DC}$, $\overleftrightarrow{HG}$, $\overleftrightarrow{EF}$

7. Line(s) perpendicular to $\overleftrightarrow{BF}$

   $\overleftrightarrow{FG}$, $\overleftrightarrow{FE}$, $\overleftrightarrow{BA}$, $\overleftrightarrow{BC}$

8. Line(s) skew to $\overleftrightarrow{CD}$ and containing point E

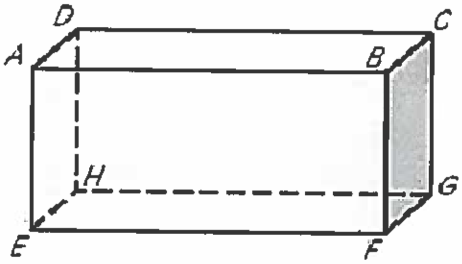
   $\overleftrightarrow{EH}$, $\overleftrightarrow{AE}$

9. Plane(s) perpendicular to plane ABE

   DAE, HEF, DAB, BCG

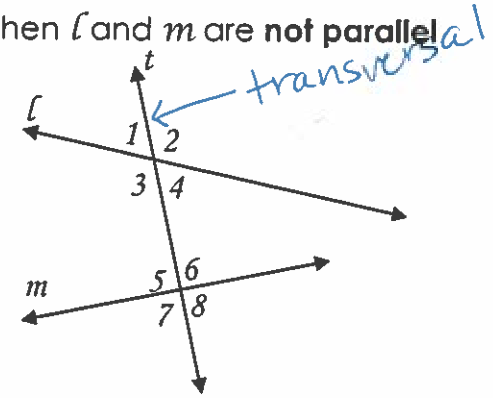
10. Plane(s) parallel to plane ABC

    EHF

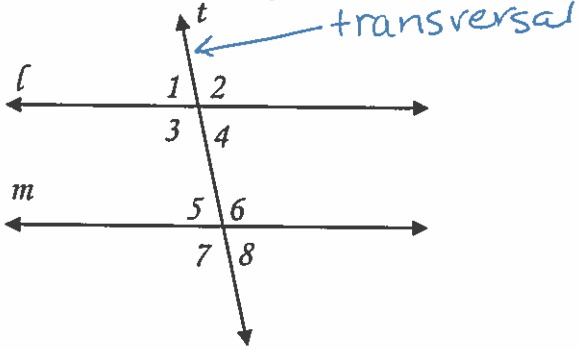


Types of Angle Pairs-When transversal t intersects lines ℓ and m, eight angles are formed.

When ℓ and m are **not parallel**



When ℓ and m are **parallel**



Type of Angle Pair	Key Words	Angle Numbers	if l and m are parallel
Vertical	Across/Diagonal	∠1 + ∠4 ∠2 + ∠3 ∠5 + ∠8 ∠6 + ∠7	Vertical angles are ALWAYS congruent
Adjacent Supplementary	Next to	∠1 + ∠2 ∠2 + ∠4 ∠3 + ∠4 ∠1 + ∠3 ∠5 + ∠6 ∠6 + ∠8 ∠7 + ∠8 ∠5 + ∠7	ALWAYS add to 180°
Corresponding	Same Side/Skip	∠1 + ∠5 ∠3 + ∠7 ∠2 + ∠6 ∠4 + ∠8	congruent
Consecutive Interior	Between two lines/Same side of transversal	∠4 + ∠6 ∠3 + ∠5	supplementary
Alternate Interior	Opposite Side/ Inside/Across	∠4 + ∠5 ∠3 + ∠6	congruent
Alternate Exterior	Opposite Side/ Outside/Across	∠1 + ∠8 ∠2 + ∠7	congruent

Interior/Exterior refer to the parallel lines.

Alternate/Consecutive refer to the transversal

Identify each pair of angles:

a) ∠9 and ∠2

vertical

b) ∠6 and ∠5

alternate exterior

c) ∠3 and ∠8

alternate interior

d) ∠7 and ∠2

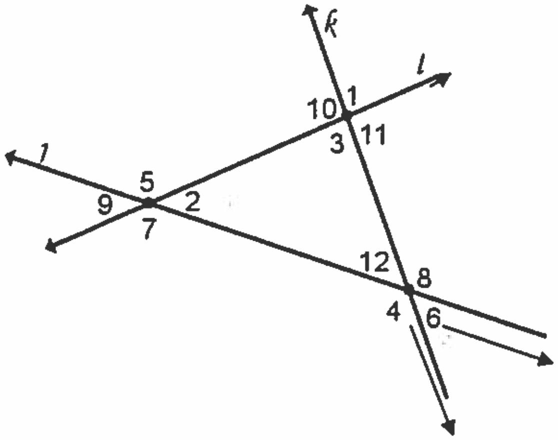
linear pair

e) ∠12 and ∠5

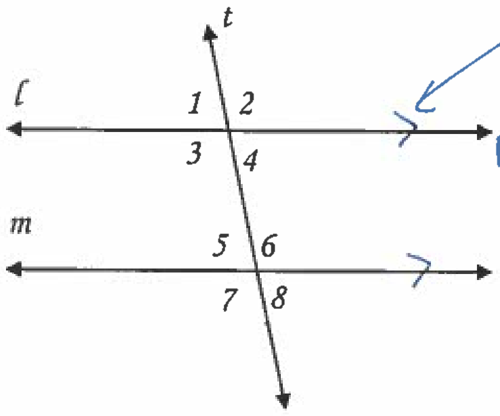
corresponding

f) ∠2 and ∠3

consecutive interior



If line l is parallel to line m, find the missing information:



these markings mean parallel

a) If ∠8 = 65°, then ∠4 = 65° vertical

b) If ∠2 = 110°, then ∠3 = 110° vertical

c) If ∠6 = 120°, then ∠5 = 60° linear pair
180-120=60°

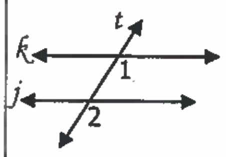
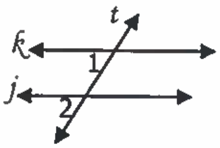
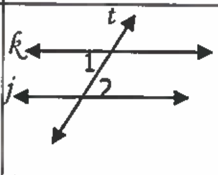
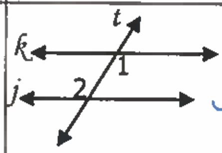
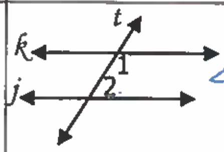
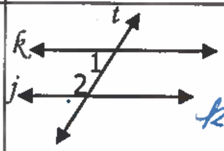
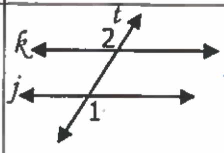
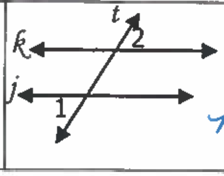
d) If ∠5 = 80°, then ∠4 = 80° alt. int

e) If ∠1 = 75°, then ∠6 = 105°

3.2 Parallel Lines and Transversals & 3.3 Proving Lines Parallel

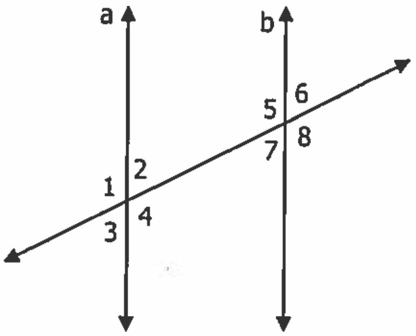
These notes will…
Use angle relationships to prove that lines are parallel.

So that we can…
Identify if two lines are parallel and find missing angle measure.

Postulate or Theorem	Definition	Diagram
Corresponding Angles Postulate	If two parallel lines are cut by a transversal, then **the pairs of corresponding angles are congruent.**	 If k || j, then $\angle 1 \cong \angle 2$
Corresponding Angles Converse Postulate	If two lines are cut by a transversal so that corresponding angles are congruent, then the **lines are parallel.**	 If $\angle 1 \cong \angle 2$, then $k \parallel j$
Alternate Interior Angles Theorem	If two parallel lines are cut by a transversal, then **the pairs of alternate interior angles are congruent.**	 If k || j, then $\angle 1 \cong \angle 2$
Alternate Interior Angles Converse Theorem	If two lines are cut by a transversal so that alternate interior are congruent, then the **lines are parallel.**	 If $\angle 1 \cong \angle 2$, then $k \parallel j$
Consecutive Interior Angles Theorem	If two parallel lines are cut by a transversal, then **the pairs of consecutive interior angles are supplementary.**	 If k || j, then $\angle 1 + \angle 2 = 180°$
Consecutive Interior Angles Converse Theorem	If two lines are cut by a transversal so that consecutive interior angles are supplementary, then the **lines are parallel.**	 If $m\angle 1 + m\angle 2 = 180$, then $k \parallel j$
Alternate Exterior Angles Theorem	If two parallel lines are cut by a transversal, then **the pairs of alternate exterior angles are congruent.**	 If k || j, then $\angle 1 \cong \angle 2$
Alternate Exterior Angles Converse Theorem	If two lines are cut by a transversal so that alternate exterior angles are congruent, then the **lines are parallel.**	 If $\angle 1 \cong \angle 2$, then $k \parallel j$

* Converse is used to prove lines parallel.

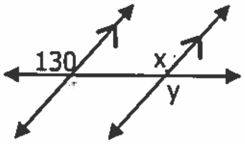
State the postulate or theorem that supports each conclusion.



1. Given: a || b
   Conclusion: ∠2 ≅ ∠7
   Alt. Int. Angles Thm.

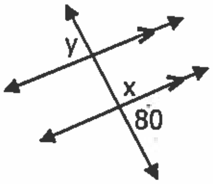
2. Given: $m\angle 4 + m\angle 7 = 180$
   Conclusion: a ll b
   Consec. Int Angles Converse Thm.

Find the values of x and y. Explain your reasoning by stating the proper theorem or postulate.

3.


x = 130°
Corresponding

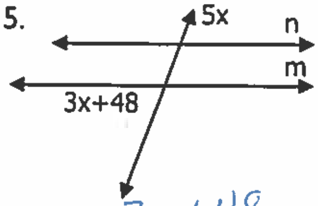
y = 130°
vertical to x

4.


x = 100°
linear pair

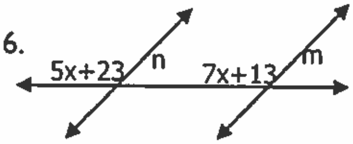
y = 80°
alternate ext ∠'s thm.

Find the value of x so that *n* || *m*. State the theorem or postulate that justifies your solution.

5.


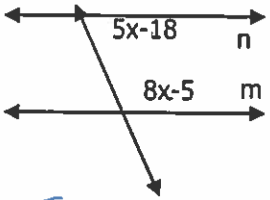
$5x = 3x + 48$
$2x = 48$
$x = 24$
Alternate Ext. ∠'s Converse

x = 24

6.


$5x + 23 = 7x + 13$
$-2x = -36$
$x = 18$
Corresponding Angles Converse Thm

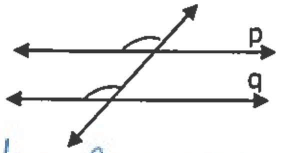
x = 18

7.


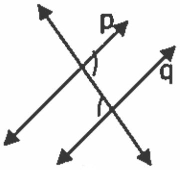
$5x - 18 + 8x - 5 = 180$
$13x - 23 = 180$
$13x = 203$
$x = \frac{203}{13}$
Consecutive Int. ∠'s Converse

x = $\frac{203}{13}$

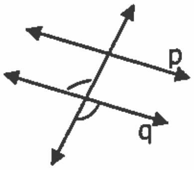
Can you prove that lines p and q are parallel? If so, state the theorem or postulate that you would use.

8.


Yes. Corresponding ∠'s Converse Thm.

9.


Yes, Alternate Int ∠'s Converse

10.


No.

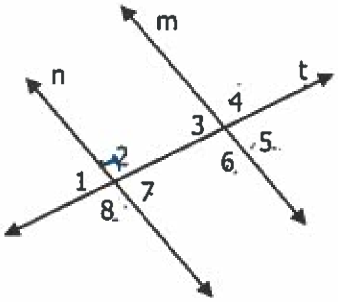
Use the figure where n // m to complete the following statements.

11. If m∠4 = 20, then m∠7= 160°.

12. If m∠5 = 75, then m∠8 = 105°.

13. If n ⊥ t, then m∠3 = 90°.

perpendicular



Use the diagram and the given information to determine if m//n, p//q, or neither.

14. ∠3 ≅ ∠10

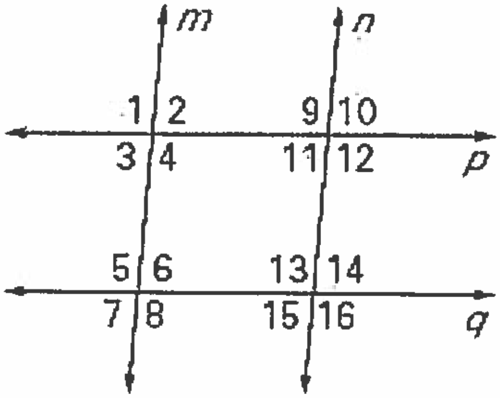
m//n

15. ∠1 ≅ ∠14

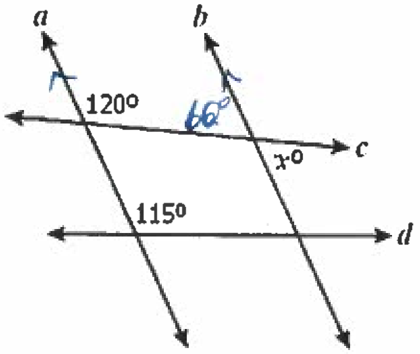
neither

16. ∠11 ≅ ∠15

p//q



17. If lines a and b are parallel, what is the value of x?



X = 60°

3.4 – Slopes of Lines

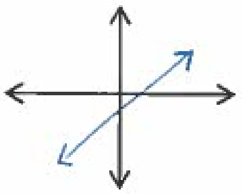
These notes we will…

Explore slope, the equation of a line, and the relationship between lines.

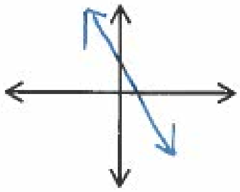
So that we can…

Find and compare slopes of lines, and create equations of lines.

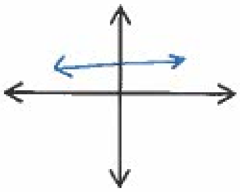
Sketch the graph of a line having the following slope:



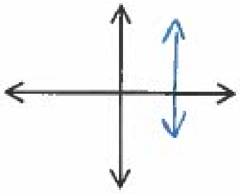
positive slope



negative slope



no slope (zero slope)



undefined slope

y = mx + b is called Slope intercept form; where m= slope, the b= y-intercept

Given 2 points, use the **slope formula**:

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

Find the slope of a line that contains the following points:

1. (2, -4), (5, 2)

(5 2)

$m = \frac{6}{3} = 2$

2. (-1, 3), (-1, -2)

(-1, -2)

$m = \frac{5}{0}$

undefined

3. (3, -1), (-6, -1)

(-6 -1)

$m = \frac{0}{9} = 0$

no slope

The slopes of 2 lines that are **parallel** are the Same.

The slopes of 2 lines that are **perpendicular** are negative reciprocals (flip + negate).

4. Given $y = \frac{2}{3}x - 7$

What is the slope of a line parallel?

$\parallel m = \frac{2}{3}$

What is the slope of a line perpendicular?

$\perp m = \frac{-3}{2}$

5. Given 4x – 2y = 9 ← 1st put into slope-intercept form

What is the slope of a line parallel?

$4x - 2y = 9$

$\frac{-2y}{-2} = \frac{-4x}{-2} + \frac{9}{-2}$

$y = 2x - \frac{9}{2}$

$\parallel m = 2$

What is the slope of a line perpendicular?

$\perp m = \frac{-1}{2}$

Determine whether the lines through the given points are ***parallel, perpendicular, or neither:***

6. Line 1: (8, 12) (7, -5)

Line 2: (-9, 3) (8, 2)

Line 1

(8, 12)
(7, -5)

$m = \frac{17}{1}$

Line 2

(-9, 3)
(8, 2)

$m = \frac{-1}{17}$

perpendicular
Line 1 ⊥ Line 2

7. Line 1: (-1, 4) (3, -4)

Line 2: (2, 7) (5, 1)

Line 1

(-1, 4)
(3, -4)

$m = \frac{-8}{4} = -2$

Line 2

(2, 7)
(5, 1)

$m = \frac{-6}{-3} = 2$

perpendicular

8. Write the slope-intercept form of the equation of the line passing through the point (1, 4) and parallel to the line y = -4x + 5.

Same slope

$m = -4$

Plug in point into $y = mx + b$

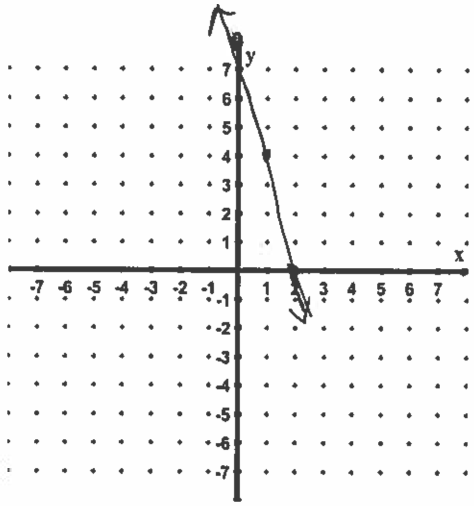
$y = mx + b$

$4 = -4(1) + b$

$4 = -4 + b$

$b = 8$

$y = -4x + 8$



3.5-Writing Equations and Graphing Lines

To write an equation of a line, you need to know 2 things: **slope(m)** and **y-intercept(b).**

For the following, graph and write an equation of the line that....

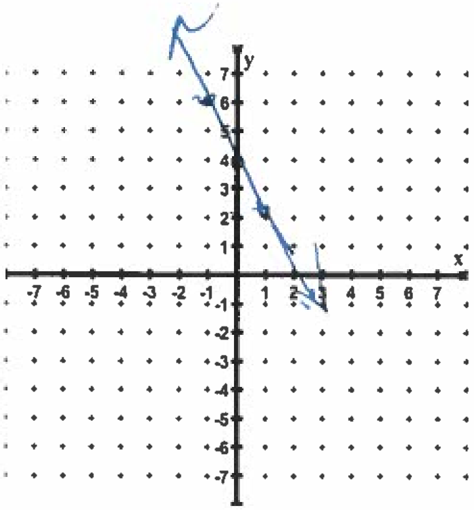
1. slope of -2 and y-intercept of 4.

m

b

$y = mx + b$

$y = {}^{-}2x + 4$



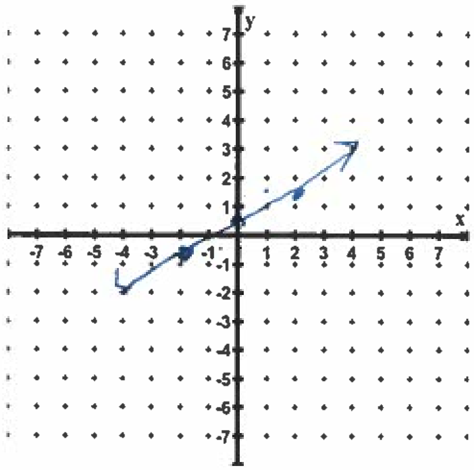
2. passes through point (1, 2) and has a slope of $\frac{3}{2}$.

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

$2 = \frac{3}{2}(1) + b$

$\frac{4}{2} - \frac{3}{2} = b$ $b = \frac{1}{2}$

$y = \frac{3}{2}x + \frac{1}{2}$



3. passes through the points (-3, 4) and (3, 2).

$-(3,2)$

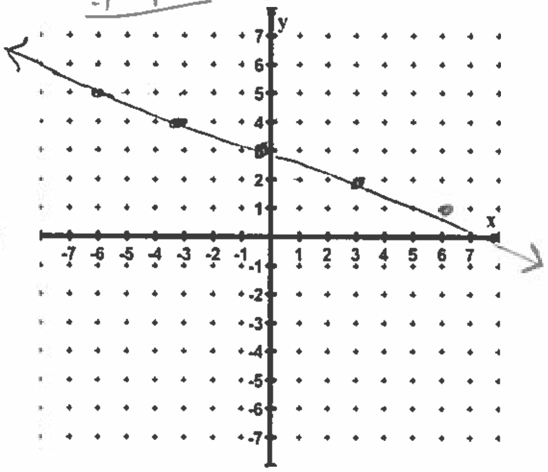
$m = \frac{2}{-6} = -\frac{1}{3}$ $y = \frac{-1}{3}x + 3$

$4 = \frac{-1}{3}(-3) + b$

$4 = 1 + b$

$-1 \quad -1$

$b = 3$



4. passes through point (-2,-3) and parallel to $y = \frac{1}{2}x + 4$.

$\parallel m = \frac{1}{2}$

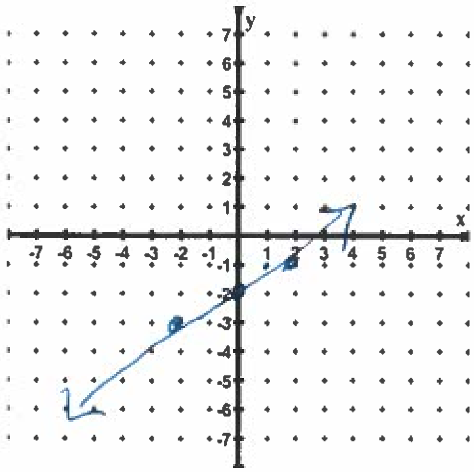
$y = mx + b$

$-3 = \frac{1}{2}(-2) + b$

$-3 = -1 + b$

$b = -2$

$y = \frac{1}{2}x - 2$



5. passes through point (-1,3) and perpendicular to $y = -\frac{1}{2}x - 1$.

$\perp m = 2$

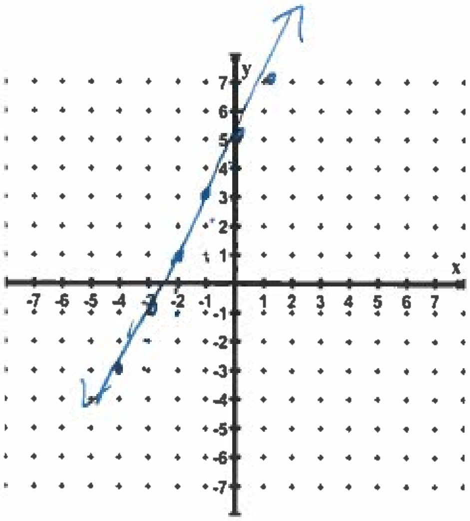
$y = mx + b$

$3 = 2(-1) + b$

$3 = -2 + b$

$5 = b$

$y = 2x + 5$



↗ undefined

6. has an undefined slope
and passes through (4,-3).

vertical
line a
y= -3

7. is perpendicular to x=3
and passes through (-2, 1).

⊥ y=1

8. is parallel to x= -2
and passes through (3, 2).

same
slope
x=3