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## I. Model Problems. <br> II. Practice <br> III. Challenge Problems <br> VI. Answer Key

## Web Resources

YouTube Slope Intercept Form
www.mathwarehouse.com/algebra/linear_equation/slope-intercept-form.php
Slope of a Line
www.mathwarehouse.com/slope2/

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## I. Model Problems

The equation of a line is given by the formula $y=m x+b$.
$m$ equals the slope of the line
$b$ equals the $y$-intercept of the line
This equation of the line is called "slope-intercept" form because it easily shows both the slope and the intercept of the line.

To find the equation of a line given the slope and intercept, simply plug into the equation.

Example 1 Write the equation of the line with slope 2 that has $y$ intercept 5.
$y=m x+b \quad$ Write the slope-intercept formula.
$y=2 x+5$
Substitute $m=2$ and $b=5$
The answer is $y=2 x+5$.
To find the equation of a line given the slope and one point on the line, plug in the slope and the coordinates of the point to solve for $b$, the $y$ intercept.

Example 2 Write the equation of the line with slope 3 that passes through the point $(-1,6)$.

$$
\begin{aligned}
& y=m x+b \\
& 6=2(-1)+b \\
& 6=-2+b \\
& b=8 \\
& y=3 x+8
\end{aligned}
$$

Write the slope-intercept formula
Substitute $m=2$ and $(x, y)=(-1$,
6)

Simplify
Add 2 to each side to solve for $b$
Substitute $m=3$ and $b=8$ into the slope-intercept formula

## The answer is $y=3 x+8$.

Sometimes the slope of the equation is not given. To find the equation of a line that passes through two points, you must first calculate the slope, then follow the steps in Example 2.

Example 3 Write the equation of the line that passes through the points $(3,-2)$ and $(-2,8)$.
$m=\frac{\text { rise }}{\text { run }}=\frac{y_{2}-y_{1}}{x_{2}-x_{1}}$
$m=\frac{8-(-2)}{-2-3}=\frac{10}{-5}=-2$
$y=m x+b$
$3=-2(-2)+b$
$3=4+b$
$b=-1$
$y=-2 x-1$

## The answer is $y=-2 x-1$.

Write the slope formula

Substitute $\left(x_{1}, y_{1}\right)=(-2,3)$ and $\left(x_{2}, y_{2}\right)=(8,-2)$
Write the point-slope form
Substitute $m=-2$ and
$(x, y)=(-2,3)$.
Simplify.
Subtract 4 from each side.
Substitute $m=-2$ and $b=-1$ into the point-slope formula.

Sometimes you will need to find the equation of a line given its graph.
Example 4 Write the equation of the line graphed below.


Notice that the graph passes through the points $(0,4)$ and $(2,-2)$. The $y$-intercept is 4 . This is the value of $b$.

$$
m=\frac{\text { rise }}{\text { run }}=\frac{y_{2}-y_{1}}{x_{2}-x_{1}}
$$

$m=\frac{4-(-2)}{0-2}=\frac{6}{-2}=-3$
$y=m x+b$
$y=-3 x+4$

Write the slope formula

Substitute $\left(x_{1}, y_{1}\right)=(2,-2)$ and $\left(x_{2}, y_{2}\right)=(0,4)$
Write the point-slope form
Substitute $m=-3$ and $b=4$ into the point-slope formula.

## II.

## Practice

Find the equation of the line that has given slope and $y$-intercept.

1. $m=2$ and $b=7$
2. $m=-3$ and $b=10$
3. $m=10$ and $b=-3$
4. $m=-7$ and $b=11$
5. $m=4$ and $b=-20$
6. $m=-12$ and $b=-8$
7. $m=6$ and $b=6$
8. $m=-5$ and $b=-10$

Find the equation of the line with the given slope that passes through the given point.
9. $m=2$ and $(-1,5)$
10. $m=-4$ and $(1,1)$
11. $m=-2$ and $(-2,-2)$
12. $m=6$ and $(2,0)$
13. $m=3$ and $(0,7)$
14. $m=-1$ and $(4,5)$
15. $m=1$ and $(-2,5)$
16. $m=0$ and $(10,7)$

Find the equation of the line that passes through the given points.
17. $(1,2)$ and $(-1,5)$
18. $(-7,-7)$ and $(-1,4)$
19. $(1,8)$ and $(-3,4)$
21. $(6,10)$ and $(2,8)$
20. $(1,5)$ and $(2,0)$
22. $(-8,4)$ and $(2,-1)$

Find the equation of each line graphed below.
23.

24.

25.

26.


## III. Challenge Problems

27. Explain why you cannot use $y=m x+b$ to find the equation of a vertical line.
28. What is the equation of a line that passes through the points $(-0.72$, 1.42 ) and (4.22, 5.83)?

## 29. Correct the Error

There is an error in the student work shown below:
Question: Find the equation of the line that passes through the points $(-1,4)$ and $(2,7)$.
Solution:
The slope is given by the formula rise over run.

$$
=\frac{7-4}{2-(-1)}=\frac{3}{3}=1
$$

Plug into $y=m x+b$;

$$
y=m x+1
$$

Substitute $(-1,4)$ to solve for $m$ :

$$
4=-1 \cdot m+1 \text { so } m=-3
$$

The equation of the line is $y=-3 x+1$.
What is the error? Explain how to solve the problem.
IV. Answer Key

1. $y=2 x+7$
2. $y=-3 x+10$
3. $y=10 x-3$
4. $y=-7 x+11$
5. $y=4 x-20$
6. $y=-12 x-8$
7. $y=6 x+6$
8. $y=-5 x-10$
9. $y=2 x+7$
10. $y=-4 x+5$
11. $y=-2 x+6$
12. $y=6 x-12$
13. $y=3 x+7$
14. $y=-x+9$
15. $y=x+7$
16. $y=7$
17. $y=-1.5 x+3.5$
18. $y=1.833 x+5.833$
19. $y=x+7$
20. $y=-5 x+10$
21. $y=0.5 x+7$
22. $y=-0.5 x$
23. $y=-2 x+7$
24. $y=-6 x+8$
25. $y=4 x+10$
26. $y=2 x+6$
27. The equation of a vertical line is an equation in the form $x=\mathrm{a}$ constant. Vertical lines have infinite slope and typically do not have a $y$-intercept.
28. $y=0.893 x+2.06$
29. The student switched the $y$-intercept and the slope in the equation of a line formula (the student mistakenly thought $b$ was the slope)
