Consortium for Worker Education

IBEW Local 3 Aptitude

Test Prep Manual

IBEW Local 3 Aptitude Entrance Exam Test Items

Math

46 minutes

5 Skills

4	Numerical Sequences
12	Plug In PEMDAS
7	Linear Equations
5	Dimensional Analysis
5	Invert Independent/Dependent

33 Questions

Reading

51 minutes

4 Technical Passages

- Lunar Tides
- Roadway Construction
- Hydroelectric
- Salt Production
- Computer
- Photosynthesis
- REM Sleep
- 3 Types of Bridges

36 Questions

Practice Materials

Learning Express
teach-nology.com
math.about.com
eei.org
math-drills.com

mechanical-aptitude-tests.com
fldoe.org/core/fileparse.php
Elevator Mechanic exam (old)
NYC Sanitation Worker Test Review Guide

Contents

Basic Math Refresher

Fraction/Decimal Conversions
Radicals
Signed Numbers

STUDY RESOURCES FOR LEVEL A

READING	ISBN
Achieving TABE Success in Reading, Level A Workbook ©2006	978-0–07–704462–6
Achieving TABE Success in Reading, Level A Reader ©2006	978-0–07–704466–4
Essential GED ©2002	978-0–07–252754–4
GED Language Arts, Reading ©2002	978-0–8092–2231–5
GED Science ©2002	978-0–8092–2230–8
GED Social Studies ©2002	978-0–8092–2229–2
TABE Skill Workbooks: Level A, Construct Meaning and Evaluate / Extend Meaning ©2011	978-0-07-660376-3
TABE Skill Workbooks: Level A, Graphic Information ©2011	978-0-07-660374-9
TABE Skill Workbooks: Level A, Words in Context and Recall Information ©2011	978-0-07-660375-6
The Complete GED ©2002	978-0–8092–9469–5
Thumbprint Mysteries, Teacher's Manual, Level Eight ©2001	978-0–8092–9584–5
Top 50 Reading Skills for GED Success ©2006	978-0-07-704481-7
Top 50 Science Skills for GED Success ©2007	978-0-07-704475-6
Top 50 Social Studies Skills for GED Success ©2007	978-0-07-704472-5
Instruction Targeted for TABE Success, Level A *(software)*	978-0-07-655485-0 (site/ LAN)
MHC Interactive: GED *(software)*	978-0-07-250328-9 (single) 978-0-07-250327-2 (site)

MATH COMPUTATION	
Achieving TABE Success in Math, Level A ©2006	978-0–07–704470-1
Calculator Power for the GED ©2002	978-0–07–251697–5
Calculator Essentials for the GED ©2003	978-0–07–286085–6
Essential GED ©2002	978-0–07–252754–4
GED Mathematics ©2002	978-0–8092–2232–2
GED Mathematics Exercise Book ©2002	978-0–8092–2237–7
Number Power 6: Word Problems ©2000	978-0–8092–2378–7
Number Power Review ©2000	978-0–8092–2379–4
TABE Skill Workbooks: Level A, Decimals and Fractions ©2011	978-0-07-660380-0
TABE Skill Workbooks: Level A, Integers and Percents©2011	978-0-07-660381-7
TABE Skill Workbooks: Level A, Numbers, Number Operations, Computation in Context, and Estimation ©2011	978-0-07-660383-1
TABE Skill Workbooks: Level A, Patterns, Functions, and Algebra ©2011	978-0-07-660386-2
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The GED Math Problem Solver ©2003	978-0–07–252755–1
The Math Problem Solver ©2003	978-0–07–294300–9
Top 50 Math Skills for GED Success ©2004	978-0–07–297383–9
Instruction Targeted for TABE Success, Level A *(software)*	978-0-07-655485-0 (site/ LAN)
MHC Interactive: GED *(software)*	978-0-07-250328-9 (single) 978-0-07-250327-2 (site)

APPLIED MATH	
Achieving TABE Success in Math, Level A ©2006	978-0–07–704470-1
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Calculator Essentials for the GED ©2003	978-0–07–286085–6
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Times Table

$6 \times 6 =$

$6 \times 7 =$

$6 \times 8 =$

$6 \times 9 =$

$7 \times 7 =$

$7 \times 8 =$

$7 \times 9 =$

$8 \times 8 =$

$8 \times 9 =$

$9 \times 9 =$

	1	2	3	4	5	6	7	8	9	10	11	12
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

n	n^2
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Addition

- Make all the denominators equal to the largest one. Multiply the numerators by the same factors.
- If borrowing, take one away from the whole number, add the numerator and denominator, and replace the numerator with the sum.
- Add/subtract the numerators and whole numbers.
- If the resulting fraction is improper, add one to the whole number, and make the numerator the difference between the numerator and the denominator.

$$4\frac{3\times4}{4\times4} + 3\frac{13}{16}$$

$$7\frac{25}{16}$$

$$8\frac{9}{16}$$

Subtraction

$$5\frac{1}{8} - 2\frac{1\times4}{2\times4}$$

$$5\frac{1}{8} - 2\frac{4}{8}$$

$$2\frac{5}{8}$$

Multiplication/Division

- Convert mixed fractions to improper fractions.
- If dividing, flip the second fraction.
- Multiply the numerators and denominators.
- Reduce and convert improper to mixed fractions.

$$4\frac{3}{8} \div 2\frac{1}{2}$$

$$\frac{8\times4+3}{8} \div \frac{2\times2+1}{2}$$

$$\frac{35}{8} \times \frac{2}{5}$$

$$\frac{7}{4}$$

$$4\overline{)7}\ 1\text{ r }3 \quad (-4) \quad 3 \qquad = \quad 1\frac{3}{4}$$

part / whole → fraction $\frac{3}{5}$ ⟺ decimal $5\overline{)3.0}\ .60$ ⟺ percentage 60%

If the ... is/are divisible by ... Then so is the number

If the	is/are divisible by		Then so is the number
last digit	2	$6 \div 2 = 3$ ✓	$2\overline{)16,526}\ 8,263$
sum of the digits	3	$8+2+6+4+4 = 24$ $24 \div 3 = 8$ ✓	$3\overline{)82,644}\ 27,548$
last two digits	4	$72 \div 4 = 18$ ✓	$4\overline{)54,872}\ 12,718$
last digit	5 (or is zero)	0 ✓	$5\overline{)89,340}\ 17,868$

Fraction	Decimal	Percent	Fraction	Decimal	Percent
$\frac{1}{8}$	0.125	12.5	$\frac{1}{3}$	$0.\overline{3}$	$33.\overline{3}$
$\frac{1}{4}$	0.25	25.0	$\frac{2}{3}$	$0.\overline{6}$	$66.\overline{6}$
$\frac{3}{8}$	0.375	37.5	$\frac{1}{20}$	0.05	5.0
$\frac{1}{2}$	0.5	50.0	$\frac{1}{10}$	0.1	10.0
$\frac{5}{8}$	0.625	62.5	$\frac{3}{20}$	0.15	15.0
$\frac{3}{4}$	0.75	75.0	$\frac{1}{5}$	0.2	20.0
$\frac{7}{8}$	0.875	87.5	$\frac{1}{12}$	$0.08\overline{3}$	$8.\overline{3}$

Finding the Part

*"what number **is**?"*

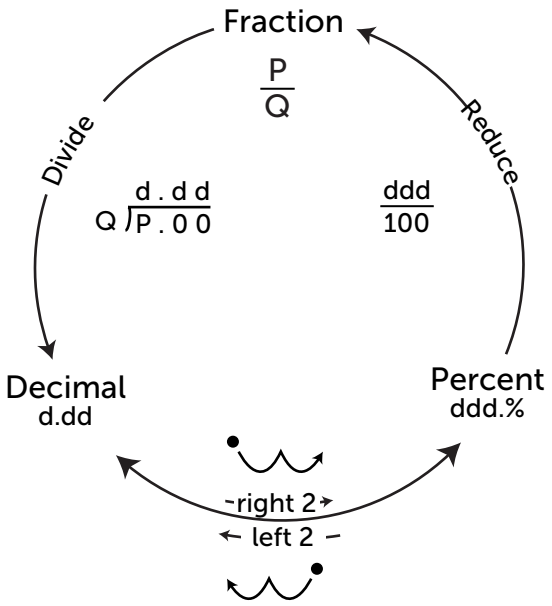
whole × %

What number is 25% of 40?

40 × 25% → 1,00. = 10.

or 40 × $\frac{1}{4}$

40 ÷ 4 = 10.



Finding the Whole

*"**of** what number?"*

part ÷ %

12 is 12.5% of what number?

12. ÷ 12.5

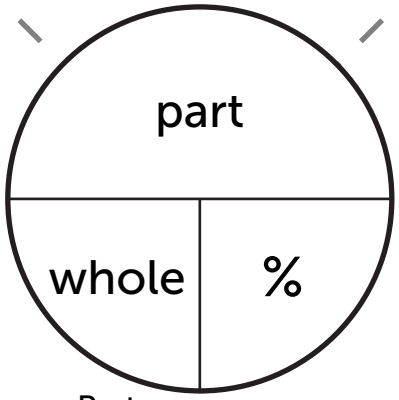
$$12.5\overline{)12.0} \qquad \begin{array}{r} .96 \\ 125\overline{)120.00} \end{array} = 96.\%$$

or 12 ÷ 12.5

12 ÷ $\frac{1}{8}$

12 × 8 = 96%

Part = Whole × Percent



Whole = $\frac{\text{Part}}{\text{Percent}}$ Percent = $\frac{\text{Part}}{\text{Whole}}$

Finding the Percentage

"what percent?"

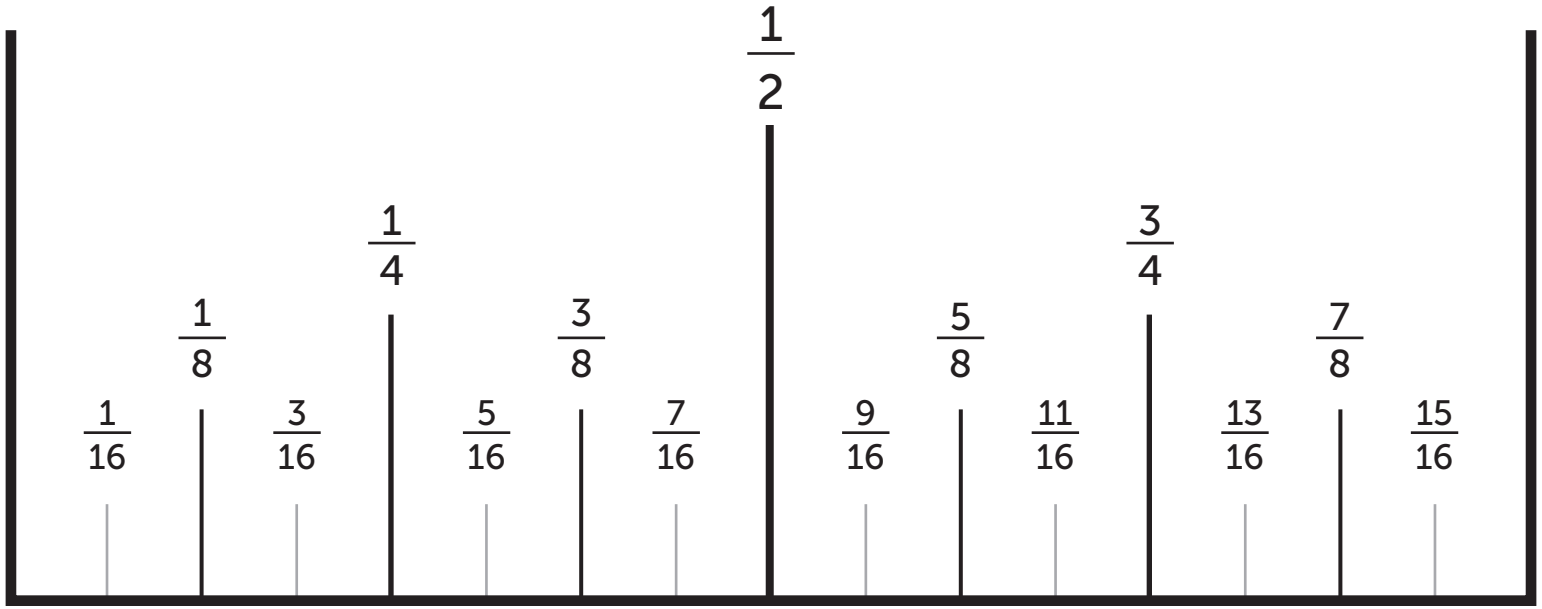
part ÷ whole

45 is what % of 60?

45. ÷ 60.

$$60.\overline{)45.00} \qquad \begin{array}{r} .75 \\ \end{array} = 75.\%$$

or $\frac{45 \div 15}{60 \div 15} = \frac{3}{4} = 75.\%$



1	/ 64	0.015625	17	/ 64	0.265625	33	/ 64	0.515625	49	/ 64	0.765625
1	/ 32	0.03125	9	/ 32	0.28125	17	/ 32	0.53125	25	/ 32	0.78125
3	/ 64	0.046875	19	/ 64	0.296875	35	/ 64	0.546875	51	/ 64	0.796875
1	**/ 16**	**0.0625**	**5**	**/ 16**	**0.3125**	**9**	**/ 16**	**0.5625**	**13**	**/ 16**	**0.8125**
5	/ 64	0.078125	21	/ 64	0.328125	37	/ 64	0.578125	53	/ 64	0.828125
3	/ 32	0.09375	11	/ 32	0.34375	19	/ 32	0.59375	27	/ 32	0.84375
7	/ 64	0.109375	23	/ 64	0.359375	39	/ 64	0.609375	55	/ 64	0.859375
1	**/ 8**	**0.125**	**3**	**/ 8**	**0.375**	**5**	**/ 8**	**0.625**	**7**	**/ 8**	**0.875**
9	/ 64	0.140625	25	/ 64	0.390625	41	/ 64	0.640625	57	/ 64	0.890625
5	/ 32	0.15625	13	/ 32	0.40625	21	/ 32	0.65625	29	/ 32	0.90625
11	/ 64	0.171875	27	/ 64	0.421875	43	/ 64	0.671875	59	/ 64	0.921875
3	**/ 16**	**0.1875**	**7**	**/ 16**	**0.4375**	**11**	**/ 16**	**0.6875**	**15**	**/ 16**	**0.9375**
13	/ 64	0.203125	29	/ 64	0.453125	45	/ 64	0.703125	61	/ 64	0.953125
7	/ 32	0.21875	15	/ 32	0.46875	23	/ 32	0.71875	31	/ 32	0.96875
15	/ 64	0.234375	31	/ 64	0.484375	47	/ 64	0.734375	63	/ 64	0.984375
1	**/ 4**	**0.25**	**1**	**/ 2**	**0.5**	**3**	**/ 4**	**0.75**	**1**	**/ 1**	**1**

Fractions That Convert to 1, 2 or 3 Decimals

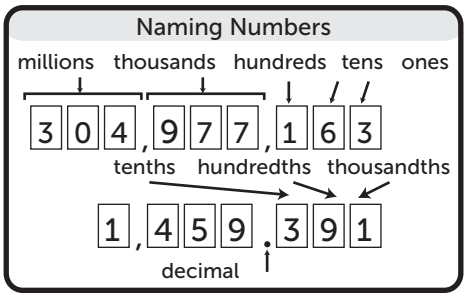
1/50	0.02	11/50	0.22	21/50	0.42	31/50	0.62	41/50	0.82
1/40	0.025	9/40	0.225	17/40	0.425	25/40	0.625	33/40	0.825
1/25	0.04	5/20	0.25	11/25	0.44	13/20	0.65	21/25	0.84
1/20	0.05	13/50	0.26	9/20	0.45	33/50	0.66	17/20	0.85
3/50	0.06	11/40	0.275	23/50	0.46	27/40	0.675	43/50	0.86
3/40	0.075	7/25	0.28	19/40	0.475	17/25	0.68	35/40	0.875
1/10	**0.1**	**3/10**	**0.3**	**5/10**	**0.5**	**7/10**	**0.7**	**9/10**	**0.9**
3/25	0.12	13/40	0.325	13/25	0.52	29/40	0.725	23/25	0.92
5/40	0.125	17/50	0.34	21/40	0.525	37/50	0.74	37/40	0.925
7/50	0.14	7/20	0.35	27/50	0.54	15/20	0.75	47/50	0.94
3/20	0.15	9/25	0.36	11/20	0.55	19/25	0.76	19/20	0.95
7/40	0.175	15/40	0.375	23/40	0.575	31/40	0.775	39/40	0.975
9/50	0.18	19/50	0.38	29/50	0.58	39/50	0.78	49/50	0.98
1/5	**0.2**	**2/5**	**0.4**	**3/5**	**0.6**	**4/5**	**0.8**	**50/50**	**1**

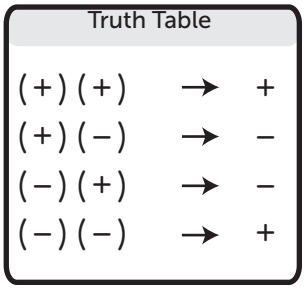
Repeating Decimals

1 / 30	0.0333	7 / 15	0.4666	1 / 9	0.1111	1 / 11	0.0909
1 / 15	0.0666	8 / 15	0.5333	2 / 9	0.2222	2 / 11	0.1818
1 / 12	0.0833	17 / 30	0.5666	**1 / 3**	**0.3333**	3 / 11	0.2727
2 / 15	0.1333	7 / 12	0.5833	4 / 9	0.4444	4 / 11	0.3636
1 / 6	0.1666	19 / 30	0.6333	5 / 9	0.5555	5 / 11	0.4545
7 / 30	0.2333	11 / 15	0.7333	**2 / 3**	**0.6666**	6 / 11	0.5454
4 / 15	0.2666	23 / 30	0.7666	7 / 9	0.7777	7 / 11	0.6363
11 / 30	0.3666	5 / 6	0.8333	8 / 9	0.8888	8 / 11	0.7272
5 / 12	0.4166	13 / 15	0.8666			9 / 11	0.8181
		11 / 12	0.9166			10 / 11	0.9090
		14 / 15	0.9333				
		29 / 30	0.9666				

Irrational Fractions

1 / 17	0.058823529411764	9 / 17	0.529411764705882
1 / 14	0.071428571428571	7 / 13	0.538461538461538
1 / 13	0.076923076923076	4 / 7	0.571428571428571
2 / 17	0.117647058823529	10 / 17	0.588235294117647
1 / 7	0.142857142857143	8 / 13	0.615384615384615
2 / 13	0.153846153846154	9 / 14	0.642857142857143
3 / 17	0.176470588235294	11 / 17	0.647058823529412
3 / 14	0.214285714285714	9 / 13	0.692307692307692
3 / 13	0.230769230769231	12 / 17	0.705882352941177
4 / 17	0.235294117647059	5 / 7	0.714285714285714
2 / 7	0.285714285714286	13 / 17	0.764705882352941
5 / 17	0.294117647058824	10 / 13	0.769230769230769
4 / 13	0.307692307692308	11 / 14	0.785714285714286
6 / 17	0.352941176470588	14 / 17	0.823529411764706
5 / 14	0.357142857142857	11 / 13	0.846153846153846
5 / 13	0.384615384615385	6 / 7	0.857142857142857
7 / 17	0.411764705882353	15 / 17	0.882352941176471
3 / 7	0.428571428571429	12 / 13	0.923076923076923
6 / 13	0.461538461538462	13 / 14	0.928571428571429
8 / 17	0.470588235294118	16 / 17	0.941176470588235





ASMD of Signed Numbers

× ÷

- Use the Truth Table to multiple/divide two numbers.
- If two signs are not separated by a number, use the Truth Table to simplify the operations.

$$-5 \times -4 = 20$$
$$-20 \div 4 = -5$$

$$-2 - (-5) = -2 + 5$$
$$2 + (-5) = 2 - 5$$

\+ −

- If both numbers are the same sign, ADD the numbers, and keep the sign.
- If the numbers have different signs, SUBTRACT the numbers, and keep the sign of the larger number.

$$5 + 3 = 8$$
$$-5 - 3 = -8$$

$$5 - 3 = 2$$
$$-5 + 3 = -2$$

ASMD of Decimal Numbers

\+ −

- Align the numbers so that the decimals form a vertical line. Add/subtract the numbers as if they were whole numbers. Place the decimal in the answer so that it lines up with the other numbers.

$$\begin{array}{r} 6.803 \\ +14.15 \\ \hline 20.953 \end{array} \qquad \begin{array}{r} 23.5 \\ -\ 9.82 \\ \hline 13.68 \end{array}$$

×

- Right justify the two factors and multiply as if they were whole numbers. Move the product's decimal to the left the total number of times it was moved in the factors.

$$\begin{array}{rl} 1.125 & \textit{3 left} \\ \times\ 3.14 & \textit{2 left} \\ \hline 4500 & \\ 1125 & \\ 3375 & \\ \hline 3.53250 & \textit{5 left} \end{array}$$

÷

- Move the decimal in the divisor to the end of the number. Move the decimal in the dividend the same number of places, filling with zeros if necessary. Align the decimal in the quotient above the dividend's decimal.

$$1.25\overline{)10.50} \quad \textit{2 right}$$

$$\begin{array}{r} 8.4 \\ 125\overline{)1,050.0} \end{array}$$

Decimal / Fraction Conversions

▶ Changing Decimals to Fractions

To change a decimal to a fraction:

1. Write the digits of the decimal as the top number of a fraction.
2. Write the decimal's name as the bottom number of the fraction.

Example: Change 0.018 to a fraction.

1. Write 18 as the top of the fraction: $\frac{18}{}$
2. Since there are three places to the right of the decimal, it's thousandths.
3. Write 1,000 as the bottom number: $\frac{18}{1{,}000}$
4. Reduce by dividing 2 into the top and bottom numbers: $\frac{18 \div 2}{1{,}000 \div 2} = \frac{9}{500}$

Now try this sample question. Step-by-step solutions to sample questions are at the end of the lesson.

Sample Question 1

Change the mixed decimal 2.7 to a fraction.

Practice

Change these decimals or mixed decimals to fractions in lowest terms.

_____ **15.** 0.1

_____ **16.** 0.03

_____ **17.** 0.75

_____ **18.** 0.6

_____ **19.** 0.005

_____ **20.** 0.125

_____ **21.** 0.046

_____ **22.** 5.04

_____ **23.** 4.15

_____ **24.** 123.45

▶ Changing Fractions to Decimals

To change a fraction to a decimal:

1. Set up a long division problem to divide the bottom number (the *divisor*) into the top number (the *dividend*)—but don't divide yet!
2. Put a decimal point and a few zeros on the right of the divisor.
3. Bring the decimal point straight up into the area for the answer (the *quotient*).
4. Divide.

Decimal / Fraction Conversions

Example: Change $\frac{3}{4}$ to a decimal.

1. Set up the division problem: $4\overline{)3}$

2. Add a decimal point and 2 zeroes to the divisor (3): $4\overline{)3.00}$

3. Bring the decimal point up into the answer: $4\overline{)3.00}$

4. Divide:

$$\begin{array}{r} .75 \\ 4\overline{)3.00} \\ \underline{28} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

Thus, $\frac{3}{4} = 0.75$, or 75 hundredths.

Practice

Change these fractions to decimals.

_____ **25.** $\frac{2}{5}$

_____ **26.** $\frac{1}{4}$

_____ **27.** $\frac{7}{10}$

_____ **28.** $\frac{1}{6}$

_____ **29.** $\frac{5}{7}$

_____ **30.** $\frac{7}{8}$

_____ **31.** $\frac{4}{9}$

_____ **32.** $3\frac{2}{7}$

_____ **33.** $4\frac{3}{4}$

_____ **34.** $2\frac{1}{5}$

Equivalent Forms Practice Problems

Problem Set 1

In problems 1 though 3, express the following fractions as decimals. In problems 4 and 5, choose the best answer for the question.

1. $\frac{4}{5}$

A. 0.08
B. 1.25
C. 0.8
D. 0.125

2. $\frac{3}{8}$

A. 0.375
B. $0.2\overline{66}$
C. $2.\overline{66}$
D. 0.0375

3. $\frac{17}{20}$

A. 0.085
B. 0.1176…
C. 1.176…
D. 0.85

4. Which of the following is equivalent to 0.42?

A. $\frac{1}{42}$
B. $\frac{42}{50}$
C. $\frac{21}{50}$
D. $\frac{42}{10}$

5. Which of the following is equivalent to 0.3?

A. $\frac{3}{100}$
B. $\frac{3}{50}$
C. $\frac{3}{10}$
D. $\frac{3}{5}$

For problems 6 through 10, express the following numbers as a percentage.

6. $\frac{7}{10}$

A. 7%
B. 0.7%
C. 70%
D. 700%

7. $\frac{27}{50}$

A. 27%
B. 0.27%
C. 5.4%
D. 54%

8. 0.28

A. 2.8%
B. 280%
C. .28%
D. 28%

9. 0.6

A. 6%
B. 0.06%
C. 60%
D. 0.6%

10. 0.347

A. 34.7%
B. 0.347%
C. 3.47%
D. 347%

Equivalent Form Practice Problems

Problem Set 1

In questions 11-15, change the percentage into an equivalent decimal or fraction.

11. 81%
- A. 81
- B. 8.1
- C. 0.81
- D. 0.081

12. 6%
- A. $\frac{3}{500}$
- B. $\frac{3}{50}$
- C. $\frac{3}{5}$
- D. $\frac{3}{1000}$

13. 500%
- A. 0.5
- B. 0.05
- C. 5
- D. 50

14. 11%
- A. 1.1
- B. 0.11
- C. 11
- D. 0.011

15. 8%
- A. $\frac{2}{25}$
- B. $\frac{1}{12}$
- C. $\frac{4}{5}$
- D. $\frac{1}{25}$

16. Which is the least number?
- A. 0.6
- B. 0.1
- C. 0.06
- D. 0.01

17. Which is the greatest number?
- A. 1.47
- B. 2.78
- C. 0 .278
- D. 14.7

18. Put these in order from least to greatest.
- A. 0.365, 0.3065, 0.37, 3.7
- B. 3.7, 0.37, 0.365, 0.3065
- C. 0.3065, 0.365, 0.37, 3.7
- D. 3.7, 0.37, .3065, 0.365

19. Put these in order from greatest to least.
- A. 0.01, 0.1, 1, 0.1256
- B. 1, 0.1256, 0.1, 0.01
- C. 0.1256, 0.1, 1, 0.01
- D. 1, 0.1, 0.1256, 0.01

20. Which of these is the least number?
- A. 50%
- B. 5
- C. 50
- D. 0.6

Equivalent Form Practice Problems

Problem Set 2

For problems 1 through 3, express the fractions as decimals. For questions 4 and 5, choose the best answers.

1. $\frac{3}{5}$

A. 0.6
B. 0.06
C. $1.\overline{66}$
D. $0.\overline{66}$

2. $\frac{5}{8}$

A. 0.0625
B. 0.625
C. 0.16
D. 1.6

3. $\frac{9}{20}$

A. $2.\overline{22}$
B. 0.45
C. 0.045
D. $0.\overline{22}$

4. Which of the following is equivalent to 0.68?

A. $\frac{68}{10}$
B. $\frac{16}{25}$
C. $\frac{1}{68}$
D. $\frac{34}{50}$

5. Express 0.2 as a fraction.

A. $\frac{2}{100}$
B. $\frac{2}{50}$
C. $\frac{2}{10}$
D. $\frac{1}{50}$

For problems 6 through 10, express the numbers as a percentage.

6. $\frac{3}{10}$

A. 3%
B. 30%
C. 0.3%
D. 0.003%

7. $\frac{31}{50}$

A. 62%
B. 6.2%
C. 31%
D. 0.31%

Equivalent Form Practice Problems

Problem Set 2

8. 0.59

A. 0.59%
B. 59%
C. 5.9%
D. 590%

9. 0.9

A. 90%
B. 9%
C. 0.9%
D. 0.032

10. 0.078

A. 78%
B. 0.78%
C. 7.8%
D. 0.078%

In questions 11-15, change the percentage into an equivalent decimal or fraction.

11. 72%

A. $\frac{18}{25}$
B. $\frac{9}{12}$
C. $\frac{9}{25}$
D. $\frac{18}{250}$

12. 7%

A. 0.07
B. 0.7
C. 7
D. 0.007

13. 320%

A. 32
B. 0.32
C. 3.2
D. 0.09

14. 13%

A. 13
B. 0.13
C. 1.3
D. 0.013

15. 6%

A. $\frac{3}{50}$
B. $\frac{2}{12}$
C. $\frac{3}{5}$
D. $\frac{3}{25}$

Equivalent FormsPractice Problems

Problem Set 2

16. Which of these is the greatest number?

A. 0.205

B. 0.0205

C. 0.0250

D. 0.250

17. Which is the least number?

A. 0.03

B. 0.1

C. 0.3

D. 0.01

18. Which is the greatest number?

A. 0.47

B. 0.047

C. 0.0475

D. 0.468

19. Arrange these in order from greatest to least.

A. 0.04, 1.3, 0.18, 0.388

B. 0.18, 1.3, 0.388, 0.04

C. 0.388, 0.18, 1.3, 0.04

D. 1.3, 0.388, 0.18, 0.04

20. Arrange these in order from least to greatest.

A. 0.201, 0.19, 1.2, 0.21

B. 0.19, 0.201, 0.21, 1.2

C. 1.2, 0.19, 0.201, 0.19

D. 0.21, 1.2, 0.201, 0.19

Convert Fractions to Decimals

The first number goes inside the Division Box

1. $\frac{3}{32}$ =

2. $\frac{41}{64}$ =

3. $\frac{7}{32}$ =

4. $\frac{1}{64}$ =

5. $\frac{61}{64}$ =

6. $\frac{49}{50}$ =

7. $\frac{1}{10}$ =

8. $\frac{27}{40}$ =

9. $\frac{1}{10}$ =

10. $\frac{21}{40}$ =

11. $\frac{8}{11}$ =

12. $\frac{8}{9}$ =

13. $\frac{4}{15}$ =

14. $\frac{3}{11}$ =

15. $\frac{5}{6}$ =

16. $\frac{1}{14}$ =

17. $\frac{5}{7}$ =

18. $\frac{5}{14}$ =

19. $\frac{3}{7}$ =

20. $\frac{5}{7}$ =

Convert Decimals to Fractions

Look for Patterns

1. 0.46875 =

2. 0.890625 =

3. 0.609375 =

4. 0.375 =

5. 0.6875 =

6. 0.984375=

7. 0.703125 =

8. 0.796875 =

9. 0.65625 =

10. 0.546875 =

11. 0.65 =

12. 0.825 =

13. 0.525 =

14. 0.04 =

15. 0.675 =

16. 1.566666667 =

17. 0.888888889 =

18. 0.777777778 =

19. 1.566666667 =

20. 0.133333333 =

ASMD of Decimals

1. 4.06 + 2.31 =

2. 2.2 + 4.97 =

3. 3.42 + 1. =

4. 2.973 + 2.5 =

5. 3.8 + 2.83 =

6. 4.31 - 1.71 =

7. 4.154 - 2.7 =

8. 3.915 - 1.65 =

9. 3.25 - 1.302 =

10. 3.7 - 1.11 =

11. 3.294 × 1.71 =

12. 2.5 × 1.02 =

13. 2.9 × 1.4 =

14. 2.37 × 2.12 =

15. 4.894 × 2. =

16. 1.667 ÷ 1.4 =

17. 2.412 ÷ 1.606 =

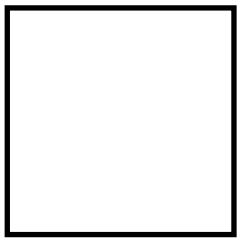
18. 3.3 ÷ 1.667 =

19. 3.915 ÷ 1.8 =

20. 1.343 ÷ 2. =

Radicals

When you think of a square, you probably think of a box-shaped figure with four equal sides like the one shown here. As you'll see in this lesson, that's a good way to think about squares *and* square roots.



FINDING SQUARES

A *square* of a number is just the number multiplied by itself. So the square of 4 is $4 \times 4 = 16$. How does this relate to a square-shaped figure? The area of a square is the amount of space a square takes up. To calculate the area of a square, you multiply the length of one side by itself. That is why the area of a square is sometimes written as *s* squared, or s^2. Any time a number is written with a 2 raised after it, it means to multiply the number by itself, or to *square* the number.

Example: What is the square of 30?
To find the square of a number, multiply it by itself. Thus, the square of 30 is 30×30, or 900.

Example: Find 9^2.
When a number is followed by a raised 2, you should square it. Thus, $9^2 = 9 \times 9 = 81$.

FINDING SQUARE ROOTS

To find a square root of a number you have to think backwards. You will be given the area of an entire square. The answer to the problem, or *square root*, is the length of only one side of the square. That is, the square root of a number is a number that when multiplied by itself equals the number given in the problem. Keep reading. It's not as tricky as it sounds.

You may have seen this symbol before: $\sqrt{}$. This is the symbol for a square root. When it is written over a number, you are being asked to find the square root of that number.

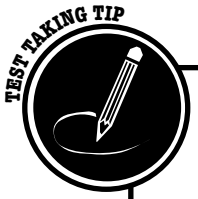
Example: What is $\sqrt{25}$?
The problem is asking you to calculate the square root of 25. Ask yourself what number multiplied by itself equals 25. If you have memorized the list of common squares, this problem is not very hard. Even if you haven't learned the list of common squares yet, though, you can figure this problem out: $5 \times 5 = 25$. So the square root of 25 is 5.

Radicals

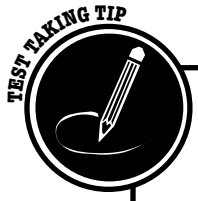
Basic Math Review

Number	Square	Calculation	Number	Square	Calculation
1	_____	1 × 1	11	_____	11 × 11
2	_____	2 × 2	12	_____	12 × 12
3	_____	3 × 3	13	_____	13 × 13
4	_____	4 × 4	14	_____	14 × 14
5	_____	5 × 5	15	_____	15 × 15
6	_____	6 × 6	16	_____	16 × 16
7	_____	7 × 7	17	_____	17 × 17
8	_____	8 × 8	18	_____	18 × 18
9	_____	9 × 9	19	_____	19 ×1 9
10	_____	10 × 10	20	_____	20 × 20

Number	Square	Calculation	Number	Square	Calculation
21	_____	21 × 21	25	_____	25 × 25
22	_____	22 × 22	26	_____	26 ×26
23	_____	23 × 23	27	_____	27 × 27
24	_____	24 × 24	28	_____	28 × 28



If you aren't sure what the square root of a given square is, make a guess. Then multiply the number by itself. If it's not the correct square root, at least now you can make a better guess the second time!



In this lesson, you are working only with whole numbers. However, sometimes math problems will ask you to calculate square roots that are not whole numbers. Read the question carefully. You might be asked to round your answer to a certain place. In other cases, you might be able to use a calculator to solve the problem.

EXAMPLE: What is $\sqrt{45}$?

The problem is asking you what number equals 45 when multiplied by itself. You know that $6^2 = 36$ and $7^2 = 49$. Thus, the square root of 45 is a number between 6 and 7. You can find a more precise answer using a calculator.

Practice

Solve each problem.

1. 2^2
2. 9^2
3. 16^2
4. 12^2
5. 6^2
6. 5^2
7. 15^2
8. 8^2
9. 3^2
10. 13^2
11. 7^2
12. 26^2
13. 35^2
14. 25^2
15. 91^2
16. $\sqrt{64}$
17. $\sqrt{36}$
18. $\sqrt{49}$
19. $\sqrt{81}$
20. $\sqrt{361}$
21. $\sqrt{529}$
22. $\sqrt{625}$
23. $\sqrt{256}$
24. $\sqrt{1{,}600}$
25. $\sqrt{441}$
26. $\sqrt{0}$
27. $\sqrt{3{,}600}$

Find the Square or Square Root of the Number

1. 27^2

2. 15^2

3. 3^2

4. 5^2

5. 30^2

6. 2^2

7. 3^2

8. 25^2

9. 20^2

10. 3^2

11. $\sqrt{529}$

12. $\sqrt{81}$

13. $\sqrt{49}$

14. $\sqrt{900}$

15. $\sqrt{49}$

16. $\sqrt{64}$

17. $\sqrt{1}$

18. $\sqrt{576}$

19. $\sqrt{784}$

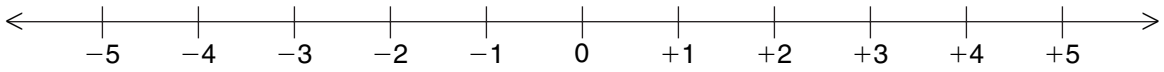
20. $\sqrt{81}$

Signed Numbers

Basic Math Review

▶ Positive and Negative Numbers

Positive and negative numbers, also called *signed* numbers, can be visualized as points along the number line:



Numbers to the left of 0 are *negative* and those to the right are *positive*. Zero is neither negative nor positive. If a number is written without a sign, it is assumed to be *positive*. On the negative side of the number line, numbers with bigger values are actually smaller. For example, -5 is *less than* -2. You come into contact with negative numbers more often than you might think; for example, very cold temperatures are recorded as negative numbers.

As you move to the right along the number line, the numbers get larger. Mathematically, to indicate that one number, say 4, is *greater than* another number, say -2, the *greater than* sign "$>$" is used:

$$4 > -2$$

Conversely, to say that -2 is *less than* 4, we use the *less than* sign, "$<$":

$$-2 < 4$$

Arithmetic with Positive and Negative Numbers

The following table illustrates the rules for doing arithmetic with signed numbers. Notice that when a negative number follows an operation (as it does in the second example), it is enclosed in parentheses to avoid confusion.

RULE	EXAMPLE
ADDITION	
If both numbers have the same sign, just add them. The answer has the same sign as the numbers being added.	$3 + 5 = 8$ $-3 + (-5) = -8$
If both numbers have different signs, subtract the smaller number from the larger. The answer has the same sign as the larger number.	$-3 + 5 = 2$ $3 + (-5) = -2$
If both numbers are the same but have opposite signs, the sum is zero.	$3 + (-3) = 0$
SUBTRACTION	
To subtract one number from another, change the sign of the number to be subtracted and then add as above.	$3 - 5 = 3 + (-5) = -2$ $-3 - 5 = -3 + (-5) = -8$ $-3 - (-5) = -3 + 5 = 2$

Signed Numbers

RULE	EXAMPLE
MULTIPLICATION	
Multiply the numbers together. If both numbers have the same sign, the answer is positive; otherwise, it is negative.	$3 \times 5 = 15$ $-3 \times (-5) = 15$ $-3 \times 5 = -15$ $3 \times (-5) = -15$
If one number is zero, the answer is zero.	$3 \times 0 = 0$
DIVISION	
Divide the numbers. If both numbers have the same sign, the answer is positive; otherwise, it is negative.	$15 \div 3 = 5$ $-15 \div (-3) = 5$ $15 \div (-3) = -5$ $-15 \div 3 = -5$
If the top number is zero, the answer is zero.	$0 \div 3 = 0$

Practice

Use the previous table to help you solve these problems with signed numbers.

_____ **1.** $2 + (-3) = ?$

_____ **2.** $-2 + (-3) = ?$

_____ **3.** $4 - (-3) = ?$

_____ **4.** $-8.5 - (-1.7) = ?$

_____ **5.** $-3 \times (-5) = ?$

_____ **6.** $-8 \div 4 = ?$

_____ **7.** $9 \div (-1.2) = ?$

_____ **8.** $-\frac{3}{5} - 1 = ?$

_____ **9.** $\frac{5}{7} \times (-\frac{7}{10}) = ?$

_____ **10.** $(-\frac{8}{3}) \div (-\frac{2}{9}) = ?$

Multiplying & Dividing Signed Numbers

Set 1

1. $-4 \cdot 4 =$
   A. 16
   B. −16
   C. 1
   D. −1
   E. None of the above

2. $-5 \cdot -5 =$
   A. −25
   B. 30
   C. −30
   D. 25
   E. None of the above

3. $-9 \cdot -3 =$
   A. −27
   B. $\frac{1}{3}$
   C. 27
   D. $-\frac{1}{3}$
   E. None of the above

4. $8 \cdot -4 =$
   A. 32
   B. 2
   C. -32
   D. −2
   E. None of the above

5. $-2 \cdot 12 =$
   A. −24
   B. $\frac{1}{6}$
   C. 6
   D. 24
   E. None of the above

6. $(-7)(-7) =$
   A. 49
   B. 1
   C. −1
   D. −49
   E. None of the above

7. $20 \cdot -2 =$
   A. 40
   B. 10
   C. −10
   D. −40
   E. None of the above

8. $-6 \cdot -7 \cdot -1 =$
   A. 42
   B. −42
   C. −13
   D. 13
   E. None of the above

9. $-8 \div 4 =$
   A. 2
   B. $\frac{1}{2}$
   C. $-\frac{1}{2}$
   D. −2
   E. None of the above

10. $32 \div -8 =$
    A. −4
    B. 4
    C. $\frac{1}{4}$
    D. $-\frac{1}{4}$
    E. None of the above

11. $\frac{-56}{8} =$
    A. 7
    B. $\frac{1}{7}$
    C. −7
    D. $-\frac{1}{7}$
    E. None of the above

Multiplying & Dividing Signed Numbers

Set 1

12. $-25 \div 5 =$

A. $\frac{1}{5}$

B. $-\frac{1}{5}$

C. 5

D. −5

E. None of the above

13. $\frac{45}{-9} =$

A. $\frac{1}{5}$

B. $-\frac{1}{5}$

C. 5

D. 6

E. None of the above

14. $2 \div -3 =$

A. $-1\frac{1}{3}$

B. $\frac{2}{3}$

C. $-\frac{2}{3}$

D. $1\frac{1}{3}$

E. None of the above

15. $\frac{-36}{-6} =$

A. 6

B. −6

C. $\frac{1}{6}$

D. $-\frac{1}{6}$

E. None of the above

16. $-48 \div -6 =$

A. −8

B. 8

C. $\frac{1}{8}$

D. $-\frac{1}{8}$

E. None of the above

17. In electrical switching, a circuit is either ON or OFF. If ON is represented by (+), OFF is represented by (-) and a push of a switch is (-), will the condition of the switch be ON or OFF if the switch begins ON and the switch is pushed 5 times?

A. ON B. OFF

18. What will be the condition of the switch if it begins OFF and the switch is pushed 6 times?

A. ON B. OFF

19. What number must −8 be multiplied by to produce a product of 64?

A. 8 B. −8
C. 7 D. −7

20. If a stock dropped 0.65 for 5 days, what was the resulting loss?

A. −$3.25 B. −$2.25
C. −$3.35 D. −$4.24

Multiplying & Dividing Signed Numbers

Set 2

1. $-3 \cdot 3 =$
A. 9
B. 1
C. −9
D. −1
E. None of the above

2. $-6 \cdot -6 =$
A. −36
B. 36
C. 1
D. −1
E. None of the above

3. $(-8)(-7) =$
A. −56
B. 48
C. −48
D. 56
E. None of the above

4. $7 \cdot -5 =$
A. 35
B. −25
C. 25
D. −35
E. None of the above

5. $-3 \cdot 15 =$
A. −45
B. 45
C. 35
D. −35
E. None of the above

6. $(-8)(-8) =$
A. −64
B. 64
C. 1
D. −1
E. None of the above

7. $30 \cdot -3 =$
A. 10
B. −90
C. −10
D. 90
E. None of the above

8. $-1 \cdot -8 \cdot -6 =$
A. 54
B. 48
C. −48
D. −54
E. None of the above

9. $-10 \div 5 =$
A. $\frac{1}{2}$
B. $-\frac{1}{2}$
C. 2
D. −2
E. None of the above

10. $42 \div -6 =$
A. −7
B. 7
C. 6
D. −6
E. None of the above

11. $\frac{-72}{9} =$
A. 8
B. $\frac{1}{8}$
C. −8
D. $-\frac{1}{8}$
E. None of the above

Multiplying & Dividing Signed Numbers

Set 2

12. $-36 \div 6 =$

A. $\frac{1}{6}$
B. 6
C. -6
D. $-\frac{1}{6}$
E. None of the above

13. $\frac{-42}{-7} =$

A. $\frac{1}{6}$
B. -6
C. 6
D. $-\frac{1}{6}$
E. None of the above

14. $-4 \div 12$

A. $-\frac{1}{3}$
B. $1\frac{1}{3}$
C. 3
D. -3
E. None of the above

15. $\frac{-60}{-5} =$

A. -12
B. 12
C. $\frac{1}{12}$
D. $-\frac{1}{12}$
E. None of the above

16. $54 \div -6 =$

A. 9
B. 8
C. $\frac{1}{9}$
D. $-\frac{1}{8}$
E. None of the above

In each of the following problems, represent each loss as a negative number and a gain as a positive number.

17. Susan lost 15 pounds over a period of five weeks. What was her average weekly weight loss?

A. 3 B. -3
C. 5 D. -5

18. The temperature dropped 25 degrees in the last 5 hours. What was the average drop in temperature each hour?

A. 5 B. -5
C. 25 D. -25

19. John owns shares of a public utility stock. The value of his stock dropped $500 in value last year. If each share of stock dropped $1.25, how many shares does John own?

A. 200 B. -200
C. 400 D. -400

20. If a negative number is multiplied by another negative an odd (1,3,5,…) number of times, the product will always be

A. Positive B. Negative

Adding & Subtracting Signed Numbers

Set 1

1. $-8 + -3 =$
A. −5
B. −11
C. 5
D. 11
E. None of the above

2. $4 + -6 =$
A. −2
B. −10
C. 10
D. 2
E. None of the above

3. $-5 + 12 =$
A. −7
B. −17
C. 17
D. 7
E. None of the above

4. $-15 + -8 =$
A. −23
B. −7
C. 23
D. 7
E. None of the above

5. $-23 + 6 =$
A. 17
B. −17
C. −29
D. 29
E. None of the above

6. $2 + -18 =$
A. −20
B. −16
C. 16
D. 20
E. None of the above

7. $9 - 4 + -3 =$
A. 8
B −2
C. 2
D. −8
E. None of the above

8. $|-6 + 2| =$
A. 8
B. 4
C. −8
D. −4
E. None of the above

9. $-10 - (-4) =$
A. 6
B. 14
C. −14
D. −6
E. None of the above

10. $7 - (-12) =$
A. −19
B. 5
C. −5
D. 20
E. None of the above

11. $-3 - 24$
A. −27
B. 27
C. 21
D. −21
E. None of the above

12. $-16 - (-8) =$
A. 24
B. −24
C. 8
D. −8
E. None of the above

Adding & Subtracting Signed Numbers

Set 1

13. 18 − (−2) =
A. −20
B. −16
C. 16
D. 21
E. None of the above

14. 9 − (−14) =
A. −23
B. 23
C. −5
D. 5
E. None of the above

15. 6 − (−8) − 2 =
A. −4
B. −12
C. 12
D. 4
E. None of the above

16.
$$\begin{array}{r} -43 \\ -\ \underline{\ 12\ } \end{array}$$
A. 55
B. −55
C. 31
D. −31
E. None of the above

17. Auto technicians doing front-end alignment on an automobile must calculate the included angle. It is the sum of the steering axis inclination and the camber angle. If the steering angle inclination is 4 1/2° and the camber angle is −1/4°, what is the included angle?

A. 4° B. 4 1/4°
C. 3 1/4° D. 4 3/4°

18. What is the included angel for a car having a steering axis inclination of 6 1/2° and a camber angle of −1/2 °?

A. 6° B. 7°
C. 6 1/2° D. 7 1/2°

19. Air temperature is measured as above or below zero. Temperatures above zero are positive numbers and below zero are negative numbers. If the temperature at 5 AM is −5 °F. and it rises 10° F by 11 AM, what is the temperature then?

A. 15° B. 5°.
C. 16° D. −5°

20. If the temperature is 15 degrees at 5 PM and drops 18 degrees, what is the temperature then?

A. −23° B. −3°
C. 3° D. −15°

Adding & Subtracting Signed Numbers

Set 2

1. −7 + −4 =
A. 11
B. −3
C. −11
D. 3
E. None of the above

2. 5 + −7 =
A. 2
B. −2
C. −12
D. 12
E. None of the above

3. −6 + 13 =
A. 7
B. −7
C. 19
D. −19
E. None of the above

4. −9 + −11 =
A. 20
B. 2
C. −2
D. −20
E. None of the above

5. −23 + 6 =
A. 17
B. −17
C. 29
D. −29
E. None of the above

6. 4 + −21 =
A. −17
B. 17
C. −26
D. 26
E. None of the above

7. 10 − 5 + −4 =
A. −1
B −9
C. 9
D. −11
E. None of the above

8. | −7 + 4 | =
A. 11
B. 3
C. −3
D. −11
E. None of the above

9. −11 − (−5) =
A. −6
B. 6
C. 16
D. −16
E. None of the above

10. 9 − (−14) =
A. −23
B. 5
C. −5
D. 23
E. None of the above

11. 22 − (−4) =
A. −26
B. 18
C. 26
D. −18
E. None of the above

12. −16 − (−7) =
A. 9
B. 23
C. −9
D. −23
E. None of the above

Adding & Subtracting Signed Numbers

Set 2

13. 19 − (−3) =
A. 22
B. 16
C. −16
D. −22
E. None of the above

14. 7 − (−12) =
A. −19
B. 5
C. −5
D. 19
E. None of the above

15. 9 − (−11) − 1=
A. 19
B. −3
C. 3
D. 21
E. None of the above

16. | −6 −(−3) | =
A. −3
B. 3
C. 9
D. −9
E. None of the above

17. The altitude of a mountain peak in California is 11,045 feet above sea level and the floor of Death Valley is 282 feet below sea level or −282 feet. What is the different in altitude between the mountain peak and the floor of Death Valley?

A. 10,763 feet B −11,327 feet.
C. 11,327 feet D. −10,763 feet

18. Stock market prices are given daily with changes from the previous day reported in positive or negative numbers depending on whether the price of the stock went up or down. If Home Depot is reported at 25.78 with a change of −1.16, what was the price of that stock yesterday?

A. 24.62 B. 23.62
C. 26.94 D. 23.72

19. If Campbell Soup's current price of 22.35 is a change of +.57 from yesterday's price, what was the price yesterday?

A. 22.78 B. 21.78
C. 21.68 D. 22.68

20. An optician determines lens prescription strength by taking the sum of the first and second measurement on a lensometer. What is the prescription strength if the first reading was +5.25 and the second was (−2.4)?

A. −2.85 B. 7.65
C. 2.85 D. −7.65

Add & Subtract Signed Numbers

Simplify "double signs" before calculating

1. -2 – -8 =

2. -8 – (-7) =

3. 6 – (-3) =

4. -1 + -8 =

5. -4 + -6 =

6. -9 – -1 =

7. -5 + 9 =

8. 8 + (-1) =

9. -9 + -5 =

10. -3 + -5 =

11. -4 – 6 =

12. -7 + 3 =

13. -5 – (-6) =

14. -4 + 6 =

15. -2 + -9 =

16. 3 + 9 =

17. 6 + (-1) =

18. -1 + (-1) =

19. 2 – (-8) =

20. -2 + -8 =

Add & Subtract Signed Numbers

Simplify "double signs" before calculating

1. 13 – 42 =

2. -70 + 43 =

3. -74 + -1 =

4. -8 + 62 =

5. -9 + (-47) =

6. 35 + 66 =

7. -81 + -67 =

8. -45 – -45 =

9. -68 + 77 =

10. -81 + -74 =

11. 57 + 68 =

12. -57 – -61 =

13. -86 – 93 =

14. -17 – (-90) =

15. -4 – -71 =

16. -78 – -38 =

17. -94 + -14 =

18. -19 + -20 =

19. -36 – -42 =

20. -82 + 11 =

Multiply Signed Numbers

Apply the Truth Table before calculating

1. (-5) (-2) =

2. (4) (-3) =

3. (-6) (3) =

4. -5 • 2 =

5. (9) (-4) =

6. (5) (-8) =

7. 5 × -2 =

8. 8 × 8 =

9. (9) (-5) =

10. -9 × -7 =

11. 5 × 8 =

12. (3) (0) =

13. 0 × -4 =

14. (2) (2) =

15. -7 • -5 =

16. (-7) (9) =

17. (6) (3) =

18. (-4) (1) =

19. -9 • 0 =

20. (2) (3) =

Multiply Signed Numbers

Apply the Truth Table before calculating

1. 23 × -78 =

2. (42) (24) =

3. -58 × -24 =

4. (53) (36) =

5. 83 × 8 =

6. (37) (97) =

7. (-91) (74) =

8. (52) (-41) =

9. 69 × 25 =

10. 62 × -18 =

11. (-27) (32) =

12. (94) (-50) =

13. (-49) (14) =

14. (-36) (-38) =

15. -82 × -9 =

16. 52 × 43 =

17. 48 × -87 =

18. -93 × 53 =

19. 49 × 54 =

20. (97) (-81) =

Divide Signed Numbers

Apply the Truth Table before calculating

1. 6 / 2 =

2. -45 / 5 =

3. 8 / -1 =

4. -15 ÷ -3 =

5. -40 / 8 =

6. -9 / 1 =

7. -18 ÷ 9 =

8. 20 / 5 =

9. -21 / 3 =

10. 4 / 2 =

11. -8 / -2 =

12. 64 / 8 =

13. -3 / 1 =

14. 24 / -8 =

15. 36 / 4 =

16. 48 / -8 =

17. 64 ÷ -8 =

18. 6 ÷ -3 =

19. -10 / 5 =

20. -45 / -5 =

Divide Signed Numbers

Apply the Truth Table before calculating

1. 135 / -27 =

2. -64 ÷ -16 =

3. 31 / -31 =

4. -279 / 93 =

5. 387 / -43 =

6. 168 ÷ -28 =

7. 413 / -59 =

8. 366 ÷ 61 =

9. -232 / 29 =

10. -63 ÷ -9 =

11. 264 ÷ 88 =

12. -696 / -87 =

13. 4 / -4 =

14. 50 / 25 =

15. -85 / 85 =

16. -54 / -9 =

17. -180 / 60 =

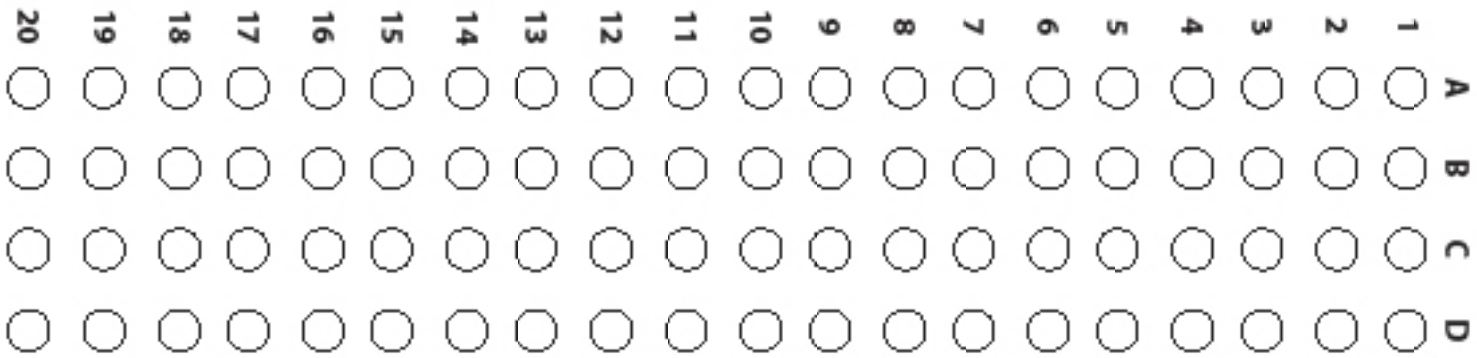
18. -144 ÷ -36 =

19. -152 ÷ 76 =

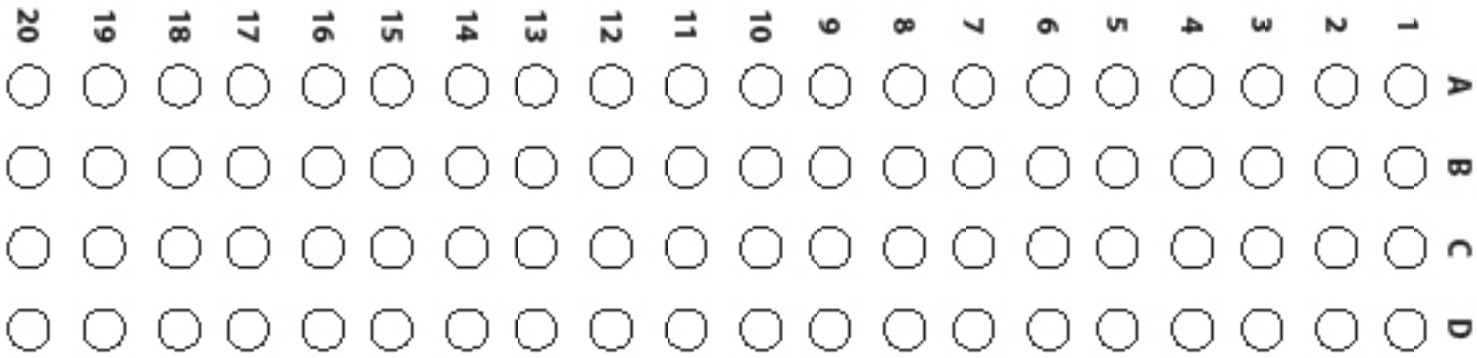
20. 73 ÷ -73 =

Name: _____

Equivalent Forms Problems Set 1

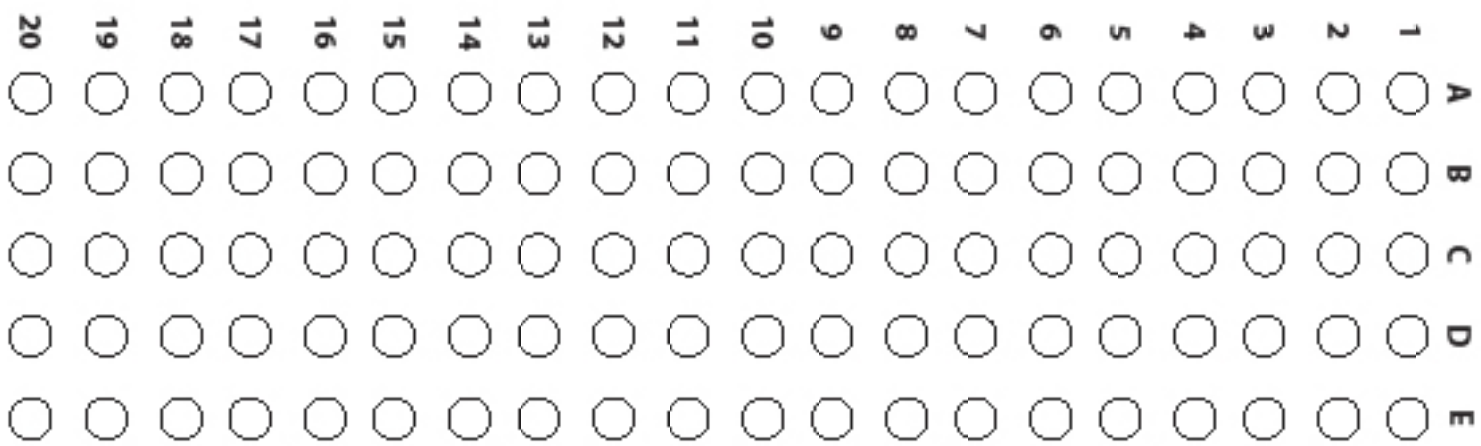


Equivalent Forms Problems Set 2

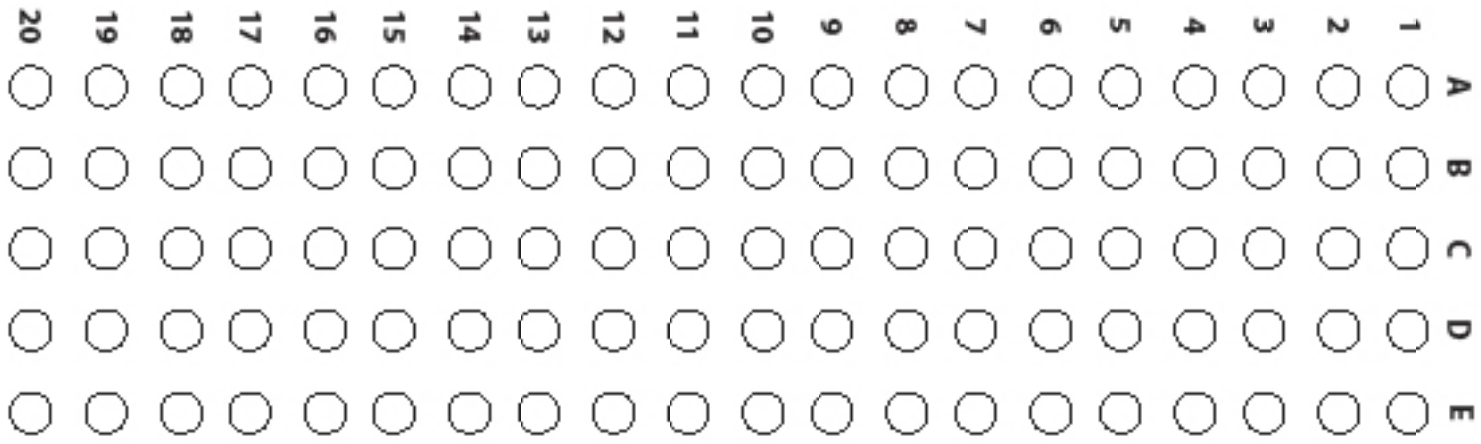


Name: _____

Addition/Subtraction of Integers Set 1

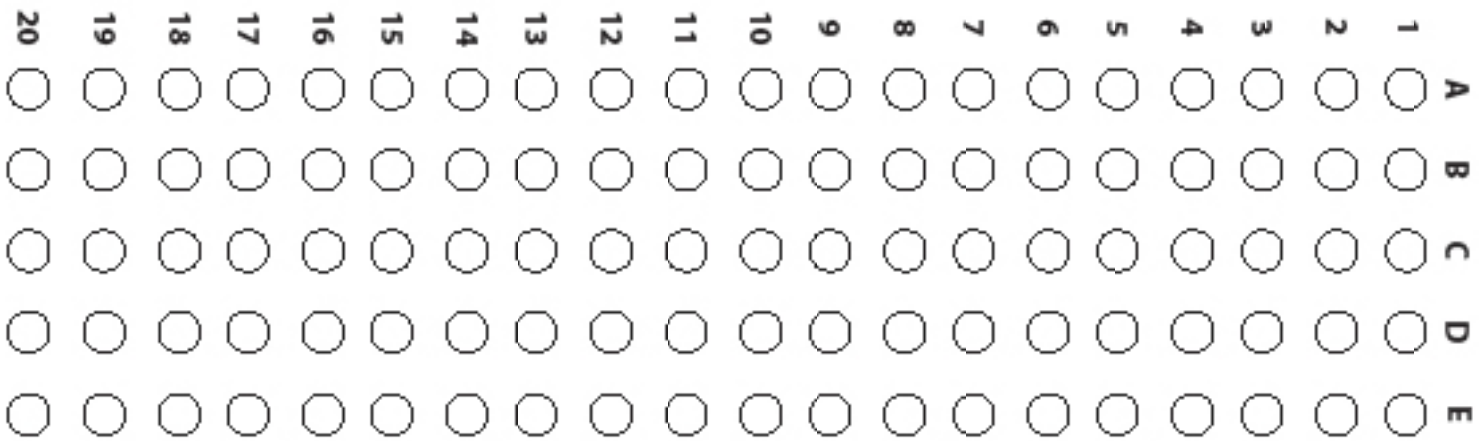


Addition/Subtraction of Integers Set 2

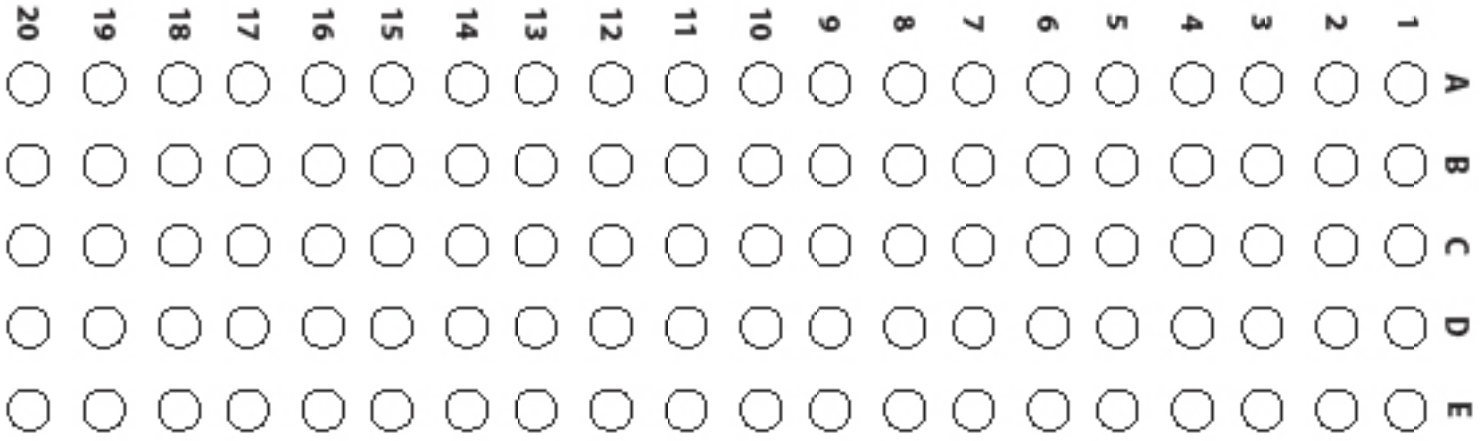


Name: _____

Multiplication/Division of Integers Set 1



Multiplication/Division of Integers Set 2



Module #1:

Numerical Sequences

Number Patterns

Make a number pattern for each of the descriptions

1. Start at 63 and subtract 4 each time. _____, _____, _____, _____, _____
2. Start at 1 and add 7 each time. _____, _____, _____, _____, _____
3. Start at 17 and add 8 each time. _____, _____, _____, _____, _____
4. Start at 50 and subtract 5 each time. _____, _____, _____, _____, _____
5. Start at 65 and subtract 6 each time. _____, _____, _____, _____, _____
6. Start at 9 and add 6 each time. _____, _____, _____, _____, _____
7. Start at 18 and add 3 each time. _____, _____, _____, _____, _____
8. Start at 70 and subtract 4 each time. _____, _____, _____, _____, _____
9. Start at 71 and subtract 2 each time. _____, _____, _____, _____, _____
10. Start at 64 and subtract 8 each time. _____, _____, _____, _____, _____
11. Start at 52 and subtract 1 each time. _____, _____, _____, _____, _____
12. Start at 58 and subtract 5 each time. _____, _____, _____, _____, _____
13. Start at 51 and subtract 1 each time. _____, _____, _____, _____, _____
14. Start at 56 and subtract 3 each time. _____, _____, _____, _____, _____
15. Start at 68 and subtract 6 each time._ _____, _____, _____, _____, _____

Number Patterns

Continue the pattern with the next two numbers

1. 19, 24, 29, 34, 39, 44, 49, ____, ____

2. 10, 19, 28, 37, 46, 55, 64, ____, ____

3. 22, 25, 28, 31, 34, 37, 40, ____, ____

4. 31, 37, 43, 49, 55, 61, 67, ____, ____

5. 60, 57, 54, 51, 48, 45, 42, ____, ____

6. 2, 6, 10, 14, 18, 22, 26, ____, ____

7. 79, 71, 63, 55, 47, 39, 31, ____, ____

8. 93, 89, 85, 81, 77, 73, 69, ____, ____

9. 97, 88, 79, 70, 61, 52, 43, ____, ____

10. 76, 71, 66, 61, 56, 51, 46, ____, ____

Number Patterns

Continue the pattern with the next two numbers

1. 43, 46, 49, 52, 55, 58, ____, ____

2. 10, 18, 9, 17, 8, 16, ____, ____

3. 50, 53, 47, 50, 44, 47, ____, ____

4. 46, 41, 42, 37, 38, 33, ____, ____

5. 90, 84, 80, 74, 70, 64, ____, ____

6. 70, 72, 64, 66, 58, 60, ____, ____

7. 5, 7, 10, 14, 19, 25, ____, ____

8. 88, 79, 71,64, 58, 53, ____, ____

9. 36, 42, 37, 43, 38, 44, ____, ____

10. 70, 69, 72, 68, 71, ____, ____

Number Patterns

Continue the pattern with the next two numbers

1. 96, 97, 88,89, 80, 81, 72, ____, ____

2. 15, 17, 20, 22, 25 , 32, ____, ____

3. 50, 51, 55, 56, 60, 61, 65, ____, ____

4. 80, 82, 79, 81, 78, 80, ____, ____

5. 55, 47, 48, 40, 41, 33, 34, ____, ____

6. 5, 10, 12, 17, 19, 24, 26, ____, ____

7. 30, 29, 38, 37, 46, 45, 54, ____, ____

8. 40, 41, 38, 40, 37, 40, 37, ____, ____

9. 34, 36, 40, 46, 54, 64, ____, ____

10. 67, 60, 63, 56, 59, ____, ____

Number Patterns

Continue the pattern with the next two numbers

1. 2, 4, 6, 12, 14, 28, 30, ____, ____

2. 3, 3, 5, 5, 7, 7, 9, 9, ____, ____

3. 5, 11, 18, 26, 35, 45, ____, ____

4. 76, 73, 75, 70, 72, 65, 67, ____, ____

5. 90, 82, 87, 80, 85, 76, ____, ____

6. 1, 2, 3, 6, 7, 14, 15, ____, ____

7. 1, 2, 4, 8, 15, 31, ____, ____

8. 90, 93, 85, 88, 81, 84, ____, ____

9. 4, 6, 8, 11, 13, 17, ____, ____

10. 96, 86, 77, 69, 62, 56, ____, ____

Number Patterns

Continue the pattern with the next two numbers

1. 9, 11, 14, 18, 23, 29, ____, ____

2. 71, 67, 65, 60, 58, 52, 50, ____, ____

3. 10, 16, 17, 24, 25, 33, 34, ____, ____

4. 2, 8, 16, 26, 38, 52, ____, ____

5. 35, 30, 38, 33, 41, 36, ____, ____

6. 99, 96, 95, 91, 90, 85, 84, ____, ____

7. 78, 74, 77, 72, 75, 69, 72, ____, ____

8. 1, 9, 16, 22, 27, 31, 34, ____, ____

9. 10, 8, 12, 9, 13, 8, 12, ____, ____

10. 24, 29, 27, 32, 29, 34, 30, ____, ____

Number Patterns

Write the next three terms in the patterns below

1. 51, 44, 37, 30, _____, _____, _____.
2. 54, 51, 48, 45, _____, _____, _____.
3. 52, 48, 44, 40, _____, _____, _____.
4. 63, 58, 53, 48, _____, _____, _____.
5. 7, 9, 11, 13, _____, _____, _____.
6. 12, 20, 28, 36, _____, _____, _____.
7. 4, 10, 16, 22, _____, _____, _____.
8. 13, 16, 19, 22, _____, _____, _____.
9. 10, 18, 26, 34, _____, _____, _____.
10. 23, 29, 35, 41, _____, _____, _____.
11. 72, 66, 60, 54, _____, _____, _____.
12. 58, 51, 44, 37, _____, _____, _____.
13. 8, 16, 24, 32, _____, _____, _____.
14. 22, 30, 38, 46, _____, _____, _____.
15. 17, 22, 27, 32, _____, _____, _____.
16. 3, 4, 5, 6, _____, _____, _____.
17. 68, 64, 60, 56, _____, _____, _____.
18. 70, 69, 68, 67, _____, _____, _____.
19. 53, 52, 51, 50, _____, _____, _____.
20. 71, 65, 59, 53, _____, _____, _____.
21. 62, 60, 58, 56, _____, _____, _____.
22. 18, 21, 24, 27, _____, _____, _____.
23. 60, 53, 46, 39, _____, _____, _____.
24. 21, 26, 31, 36, _____, _____, _____.
25. 66, 64, 62, 60, _____, _____, _____.
26. 65, 60, 55, 50, _____, _____, _____.
27. 24, 31, 38, 45, _____, _____, _____.
28. 16, 20, 24, 28, _____, _____, _____.
29. 73, 72, 71, 70, _____, _____, _____.
30. 69, 67, 65, 63, _____, _____, _____.

Practice Questions

▶ Set 3 (Answers begin on page 102.)

This set will give you additional practice dealing with number series questions.

41. 44 41 38 35 32 29 26
- **a.** 24 21
- **b.** 22 19
- **c.** 23 19
- **d.** 29 32
- **e.** 23 20

42. 6 10 14 18 22 26 30
- **a.** 36 40
- **b.** 33 37
- **c.** 38 42
- **d.** 34 36
- **e.** 34 38

43. 34 30 26 22 18 14 10
- **a.** 8 6
- **b.** 6 4
- **c.** 14 18
- **d.** 6 2
- **e.** 4 0

44. 2 44 4 41 6 38 8
- **a.** 10 12
- **b.** 35 32
- **c.** 34 9
- **d.** 35 10
- **e.** 10 52

45. 32 29 26 23 20 17 14
- **a.** 11 8
- **b.** 12 8
- **c.** 11 7
- **d.** 32 29
- **e.** 10 9

46. 14 14 26 26 38 38 50
- **a.** 60 72
- **b.** 50 62
- **c.** 50 72
- **d.** 62 62
- **e.** 62 80

47. 8 12 9 13 10 14 11
- **a.** 14 11
- **b.** 15 12
- **c.** 8 15
- **d.** 15 19
- **e.** 8 5

48. 4 7 26 10 13 20 16
- **a.** 14 4
- **b.** 14 17
- **c.** 18 14
- **d.** 19 13
- **e.** 19 14

49. 3 8 10 15 17 22 24
- **a.** 26 28
- **b.** 29 34
- **c.** 29 31
- **d.** 26 31
- **e.** 26 32

50. 17 14 14 11 11 8 8
- **a.** 8 5
- **b.** 5 2
- **c.** 8 2
- **d.** 5 5
- **e.** 5 8

51. 13 29 15 26 17 23 19
- **a.** 21 23
- **b.** 20 21
- **c.** 20 17
- **d.** 25 27
- **e.** 22 20

Practice Questions

52. 16 26 56 36 46 68 56
- **a.** 80 66
- **b.** 64 82
- **c.** 66 80
- **d.** 78 68
- **e.** 66 82

53. 7 9 66 12 14 66 17
- **a.** 19 66
- **b.** 66 19
- **c.** 19 22
- **d.** 20 66
- **e.** 66 20

54. 3 5 35 10 12 35 17
- **a.** 22 35
- **b.** 35 19
- **c.** 19 35
- **d.** 19 24
- **e.** 22 24

55. 36 31 29 24 22 17 15
- **a.** 13 11
- **b.** 10 5
- **c.** 13 8
- **d.** 12 7
- **e.** 10 8

56. 42 40 38 35 33 31 28
- **a.** 25 22
- **b.** 26 23
- **c.** 26 24
- **d.** 25 23
- **e.** 26 22

57. 11 14 14 17 17 20 20
- **a.** 23 23
- **b.** 23 26
- **c.** 21 24
- **d.** 24 24
- **e.** 24 27

58. 17 32 19 29 21 26 23
- **a.** 25 25
- **b.** 20 22
- **c.** 23 25
- **d.** 25 22
- **e.** 27 32

59. 10 34 12 31 14 28 16
- **a.** 25 18
- **b.** 30 13
- **c.** 19 26
- **d.** 18 20
- **e.** 25 22

60. 32 31 32 29 32 27 32
- **a.** 25 32
- **b.** 31 32
- **c.** 29 32
- **d.** 25 30
- **e.** 29 30

Practice Questions

Homework
Cut 68-

▶ Set 4 (Answers begin on page 103.)

This set contains additional number series questions, some of which are in Roman numerals. These items differ from Sets 1, 2, and 3 because they ask you to find the number that fits somewhere into the *middle* of the series. Some of the items involve both numbers and letters; for these questions, look for a number series *and* a letter series. (For additional practice in working letter series questions, see Set 5.)

61. Look at this series: 8, 43, 11, 41, __, 39, 17, . . .
What number should fill in the blank?
a. 8
b. 14
c. 43
d. 44

62. Look at this series: 15, __, 27, 27, 39, 39, . . .
What number should fill the blank?
a. 51
b. 39
c. 23
d. 15

63. Look at this series: 83, 73, 93, 63, __, 93, 43, . . .
What number should fill the blank?
a. 33
b. 53
c. 73
d. 93

64. Look at this series: 4, 7, 25, 10, __, 20, 16, 19, . . .
What number should fill the blank?
a. 13
b. 15
c. 20
d. 28

65. Look at this series: 72, 76, 73, 77, 74, __, 75, . . .
What number should fill the blank?
a. 70
b. 71
c. 75
d. 78

66. Look at this series: 70, 71, 76, __, 81, 86, 70, 91, . . .
What number should fill the blank?
a. 70
b. 71
c. 80
d. 96

67. Look at this series: 664, 332, 340, 170, __, 89, . . .
What number should fill the blank?
a. 85
b. 97
c. 109
d. 178

Numerical Reasoning Test 2

Answer as many questions as you can in 20 minutes. Bubble in your answers on the separate answer sheet

Identify the missing number at the end of the series.

	A	B	C	D	E	
1) 3, 9, 15, 21, ?	30	27	25	28	29	**A B C D E**
2) 4, 13, 21, 28, ?	37	36	31	34	33	**A B C D E**
3) 798, 777, 756, 735, ?	712	711	720	710	714	**A B C D E**
4) 2, 5, 9, 14, 20, ?	23	29	27	25	28	**A B C D E**

Identify the missing number or letter within the series.

	A	B	C	D	E	
6) 16, 18, 21, ?, 30	27	28	22	25	26	**A B C D E**
7) 97, 94, ?, 79, 67, 52	88	86	70	81	82	**A B C D E**
8) 21, ?, 8, 5, 3, 2	12	14	13	17	11	**A B C D E**
9) ?, 125, 64, 27, 8, 1	298	200	175	216	210	**A B C D E**

Numerical Reasoning Test 3

Answer as many questions as you can in 20 minutes. Bubble in your answers on the separate answer sheet

Identify the missing number at the end of the series.

	A	B	C	D	E	
1) 7, 11, 15, 19, ?	22	23	24	25	26	**A B C D E**
2) 11, 16, 26, 41, ?	58	60	59	61	66	**A B C D E**
3) 28, 35, 42, 49, 56, ?	62	63	64	65	66	**A B C D E**
4) 97, 94, 88, 79, 67, ?	52	50	49	47	44	**A B C D E**
5) 72, 63, 54, 45, ?	32	33	36	39	35	**A B C D E**

Identify the missing number or letter within the series.

	A	B	C	D	E	
6) 195, ?, 180, 170, 165	192	188	185	190	182	**A B C D E**
7) 3, 5, 15, 17, 27, ?, 39	31	29	25	35	30	**A B C D E**
8) 54, ?, 28, 18, 10, 4	36	35	37	41	40	**A B C D E**
9) 1, 3, ?, 9, 27, 243	4	3	5	6	7	**A B C D E**

Numerical Reasoning Test 4

Answer as many questions as you can in 20 minutes. Bubble in your answers on the separate answer sheet

Identify the missing number at the end of the series.

	A	B	C	D	E	
1) 5, 12, 19, 26, ?	31	33	35	34	37	**A B C D E**
2) 11, 16, 26, 41, ?	51	56	61	66	46	**A B C D E**
3) 100, 96, 91, 85, ?	74	75	77	78	79	**A B C D E**
4) 5, 12, 26, 47, ?	66	65	60	70	75	**A B C D E**
5) 0, 4, 9, 13, 18, ?	22	20	24	21	25	**A B C D E**

Identify the missing number within the series.

	A	B	C	D	E	
6) ?, 14, 12, 11, 11, 12	14	17	18	15	16	**A B C D E**
7) 11, 30, ?, 68, 87, 106	50	52	40	49	47	**A B C D E**
8) 68, 72, 75, ?, 82, 86	80	78	77	81	79	**A B C D E**
9) ?, 30, 35, 25, 30, 20	40	45	25	20	30	**A B C D E**
10) 54, 40, 28, ?, 10, 4	24	16	18	14	15	**A B C D E**

Numerical Sequences

Find the missing number

1.	73	87	102	118	◯	153
2.	-43	-60	-74	◯	-93	-98
3.	47	52	55	◯	55	52
4.	47	26	◯	-13	-31	-48
5.	57	67	77	◯	97	107
6.	47	◯	29	20	11	2
7.	67	70	72	73	◯	72
8.	51	56	◯	72	83	96
9.	37	48	59	70	◯	92
10.	◯	31	17	5	-5	-13
11.	◯	-18	-1	20	45	74
12.	37	55	◯	100	127	157
13.	29	48	65	◯	93	104
14.	71	90	109	128	147	◯
15.	73	93	◯	133	153	173
16.	-59	-40	-16	13	◯	86
17.	◯	-30	-15	2	21	42
18.	17	13	10	◯	7	7
19.	-31	-23	-15	◯	1	9
20.	◯	75	80	82	81	77

21.	-43	-49	◯	-61	-67	-73
22.	◯	35	56	80	107	137
23.	73	84	99	118	◯	168
24.	-83	-70	-62	-59	-61	◯
25.	7	22	◯	52	67	82
26.	-11	-4	◯	10	17	24
27.	◯	-12	5	20	33	44
28.	-59	-63	-69	-77	◯	-99
29.	29	23	◯	14	11	9
30.	29	37	46	◯	67	79
31.	◯	92	109	124	137	148
32.	73	64	52	◯	19	-2
33.	53	47	◯	32	23	13
34.	17	11	5	-1	◯	-13
35.	-31	-9	16	44	◯	109
36.	-43	-35	◯	-22	-17	-13
37.	7	-9	-30	-56	-87	◯
38.	51	69	88	108	129	◯
39.	-11	8	◯	43	59	74
40.	67	70	75	◯	91	102

41.	47	58	70	83	◯	112
42.	37	57	76	◯	111	127
43.	71	54	37	◯	3	-14
44.	-43	-59	◯	-91	-107	-123
45.	53	37	21	◯	-11	-27
46.	37	◯	85	115	149	187
47.	-59	-44	-27	-8	◯	36
48.	-83	-68	◯	-47	-41	-38
49.	71	55	42	32	◯	21
50.	◯	50	63	76	89	102
51.	◯	53	50	48	47	47
52.	37	47	◯	70	83	97
53.	73	64	56	◯	43	38
54.	79	89	101	115	131	◯
55.	71	79	◯	89	91	91
56.	17	25	34	44	◯	67
57.	◯	-70	-55	-38	-19	2
58.	73	67	65	◯	73	83
59.	-43	-47	-51	◯	-59	-63
60.	◯	29	50	70	89	107

61.	37	21	◯	-11	-27	-43
62.	◯	31	49	71	97	127
63.	57	76	98	123	◯	182
64.	-11	3	20	40	63	◯
65.	-83	-80	◯	-68	-59	-48
66.	71	79	◯	101	115	131
67.	◯	55	62	68	73	77
68.	71	81	91	101	◯	121
69.	-11	-4	◯	1	-1	-6
70.	71	62	55	◯	47	46
71.	◯	50	49	44	35	22
72.	29	20	12	◯	-1	-6
73.	-43	-38	◯	-28	-23	-18
74.	73	95	117	139	◯	183
75.	29	44	59	74	◯	104
76.	33	43	◯	66	79	93
77.	-31	-20	-9	2	13	◯
78.	51	56	61	66	71	◯
79.	53	71	◯	113	137	163
80.	-59	-41	-20	◯	31	61

81.	-43	-32	-21	-10	◯	12
82.	41	49	62	◯	103	131
83.	33	53	76	◯	131	163
84.	73	81	◯	103	117	133
85.	-43	-28	-10	◯	35	62
86.	47	◯	87	107	127	147
87.	37	20	6	-5	◯	-18
88.	7	15	◯	40	57	77
89.	57	51	42	30	◯	-3
90.	◯	-17	-8	-4	-5	-11
91.	◯	72	89	104	117	128
92.	79	87	◯	103	111	119
93.	79	97	120	◯	181	219
94.	-43	-23	-3	17	37	◯
95.	41	32	◯	8	-7	-24
96.	29	25	21	17	◯	9
97.	◯	99	121	145	171	199
98.	-11	-32	-57	◯	-119	-156
99.	73	64	57	◯	49	48
100.	◯	60	60	57	51	42

Set 1

	A	B	C	D	E
1	○	○	○	○	○
2	○	○	○	○	○
3	○	○	○	○	○
4	○	○	○	○	○
5	○	○	○	○	○
6	○	○	○	○	○
7	○	○	○	○	○
8	○	○	○	○	○
9	○	○	○	○	○
10	○	○	○	○	○
11	○	○	○	○	○
12	○	○	○	○	○
13	○	○	○	○	○
14	○	○	○	○	○
15	○	○	○	○	○
16	○	○	○	○	○
17	○	○	○	○	○
18	○	○	○	○	○
19	○	○	○	○	○
20	○	○	○	○	○

Set 2

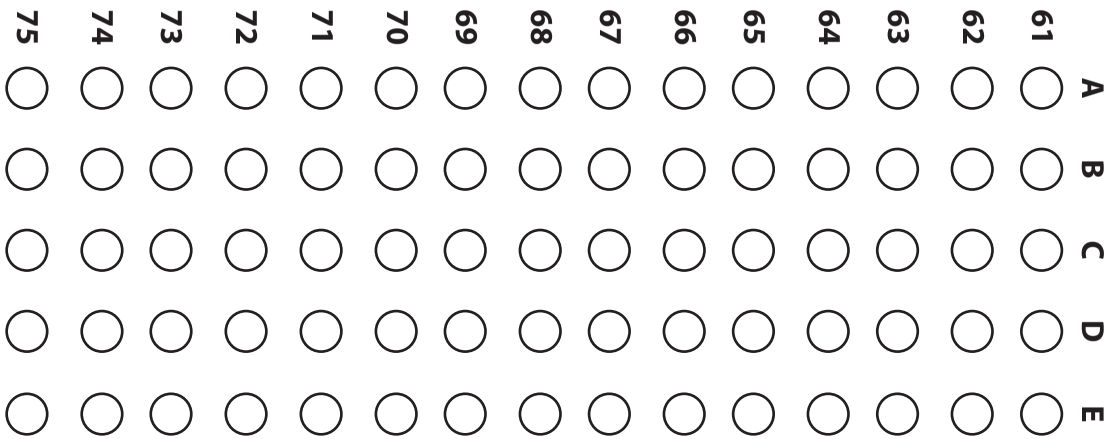
	A	B	C	D	E
21	○	○	○	○	○
22	○	○	○	○	○
23	○	○	○	○	○
24	○	○	○	○	○
25	○	○	○	○	○
26	○	○	○	○	○
27	○	○	○	○	○
28	○	○	○	○	○
29	○	○	○	○	○
30	○	○	○	○	○
31	○	○	○	○	○
32	○	○	○	○	○
33	○	○	○	○	○
34	○	○	○	○	○
35	○	○	○	○	○
36	○	○	○	○	○
37	○	○	○	○	○
38	○	○	○	○	○
39	○	○	○	○	○
40	○	○	○	○	○

Set 3

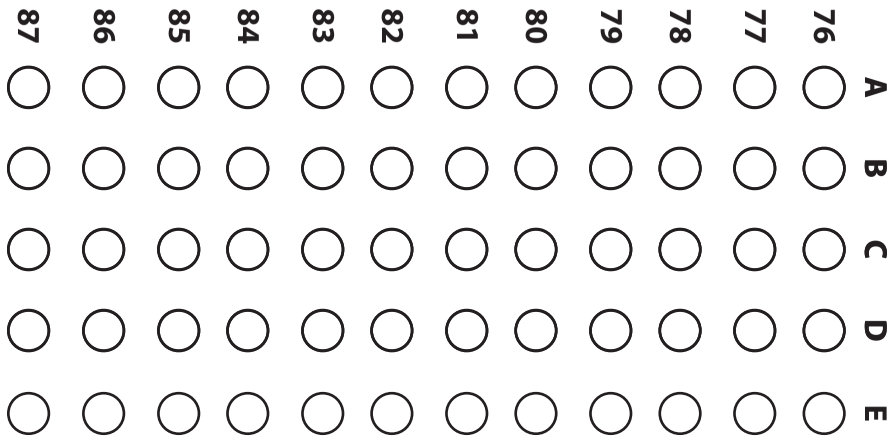
	A	B	C	D	E
41	○	○	○	○	○
42	○	○	○	○	○
43	○	○	○	○	○
44	○	○	○	○	○
45	○	○	○	○	○
46	○	○	○	○	○
47	○	○	○	○	○
48	○	○	○	○	○
49	○	○	○	○	○
50	○	○	○	○	○
51	○	○	○	○	○
52	○	○	○	○	○
53	○	○	○	○	○
54	○	○	○	○	○
55	○	○	○	○	○
56	○	○	○	○	○
57	○	○	○	○	○
58	○	○	○	○	○
59	○	○	○	○	○
60	○	○	○	○	○

Name: _____

Set 4



Set 5



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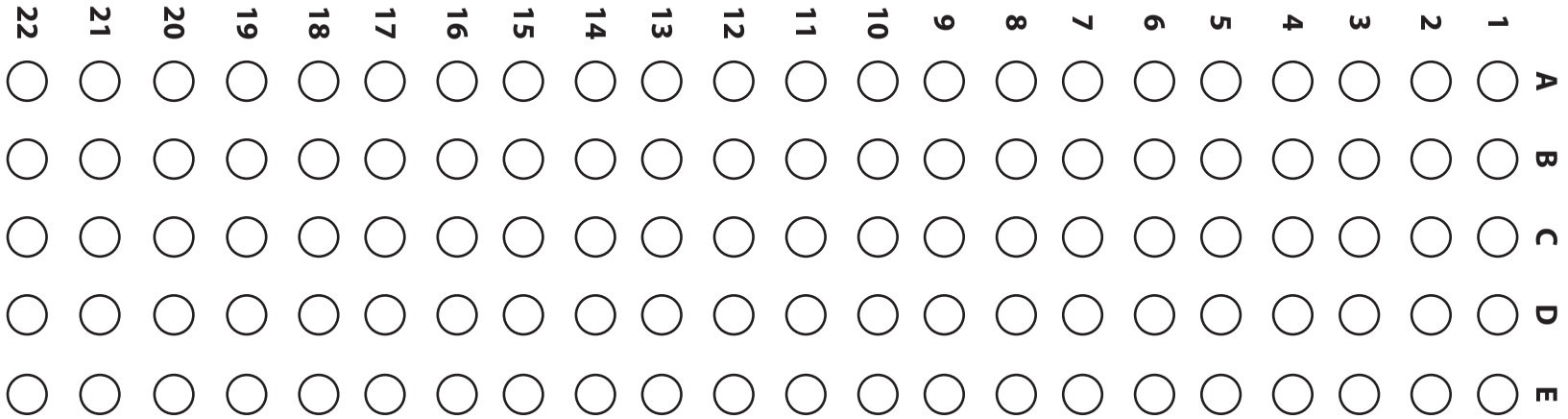
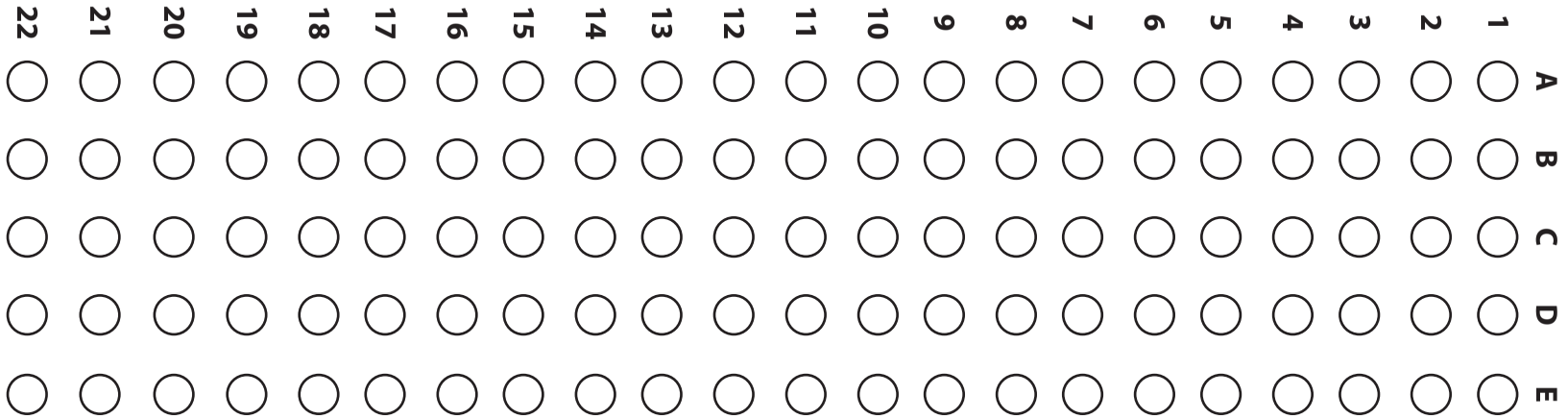
Numerical Reasoning Test 1



Numerical Reasoning Test 2



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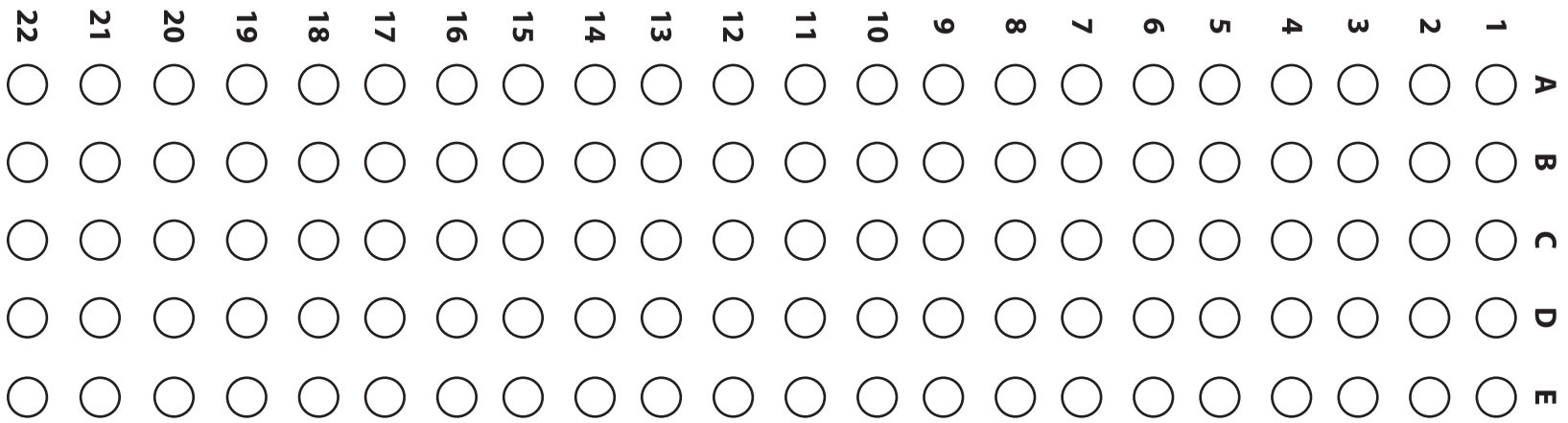
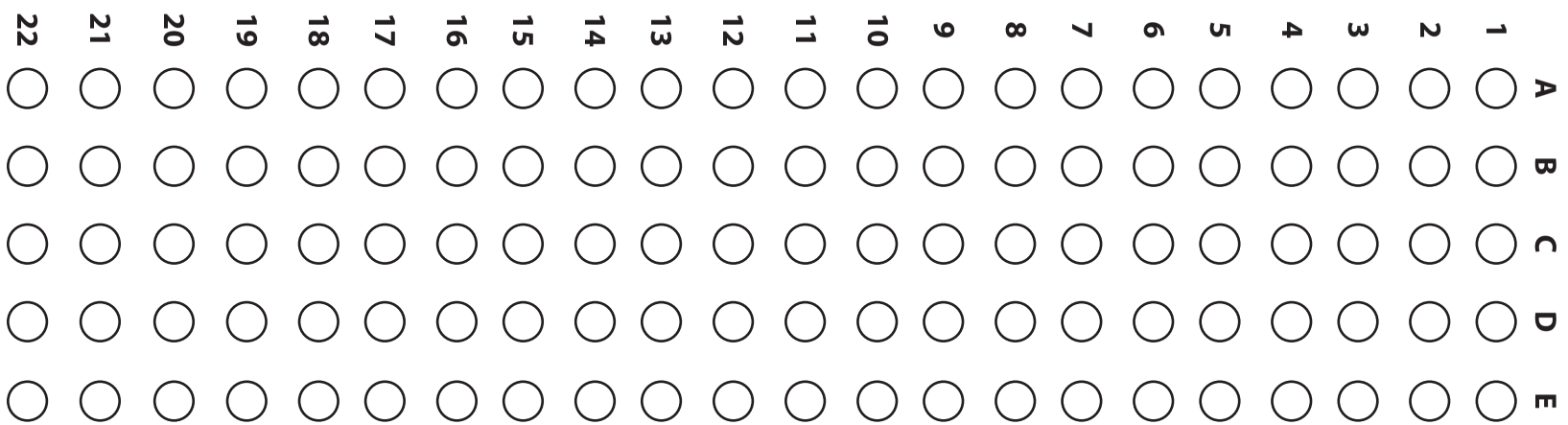
Numerical Reasoning Test 3



Numerical Reasoning Test 4



Module #2:
Plug In PEMDAS

Order of Operations

For some people, it is helpful to try to simplify expressions containing signed numbers as much as possible. When you find signed numbers with addition and subtraction operations, you can simplify the task by changing all subtraction to addition. Subtracting a number is the same as adding its opposite. For example, subtracting a three is the same as adding a negative three. Or subtracting a negative 14 is the same as adding a positive 14. As you go through the step-by-step answer explanations, you will begin to see how this process of using only addition can help simplify your understanding of operations with signed numbers. As you begin to gain confidence, you may be able to eliminate some of the steps by doing them in your head and not having to write them down. After all, that's the point of practice! You work at the problems until the process becomes automatic. Then you own that process and you are ready to use it in other situations.

The **Tips for Working with Integers** section that follows gives you some simple rules to follow as you solve problems with integers. Refer to them each time you do a problem until you don't need to look at them. That's when you can consider them yours.

You will also want to review the rules for Order of Operations with numerical expressions. You can use a memory device called a *mnemonic* to help you remember a set of instructions. Try remembering the word **PEMDAS**. This nonsense word helps you remember to:

P do operations inside *Parentheses*
E evaluate terms with *Exponents*
M D do *Multiplication* and *Division* in order from left to right
A S *Add* and *Subtract* terms in order from left to right

Word Translations

EQUALS **key words: is, are, has**

English	Math
Bob **is** 18 years old.	$B = 18$
There **are** 7 hats.	$h = 7$
Judi **has** 5 books.	$J = 5$

ADD **key words: sum; more, greater, or older than; total; altogether**

English	Math
The **sum** of two numbers is 10.	$x + y = 10$
Karen has \$5 **more than** Sam.	$K = 5 + S$
The base is 3" **greater than** the height.	$b = 3 + h$
Judi is 2 years **older than** Tony.	$J = 2 + T$
Al threw the ball 8 feet **further than** Mark.	$A = 8 + M$
The **total** of three numbers is 25.	$a + b + c = 25$
How much do Joan and Tom have **altogether**?	$J + T = ?$

SUBTRACT **key words: difference; fewer, less, or younger than; remain; left over**

English	Math
The **difference** between two numbers is 17.	$x - y = 17$
Jay is 2 years **younger than** Brett.	$J = B - 2$ (NOT $2 - B$)
After Carol ate 3 apples, r apples **remained.**	$r = a - 3$
Mike has 5 **fewer** cats **than** twice the number Jan has.	$M = 2J - 5$

MULTIPLY **key words: of, product, times**

English	Math
25% **of** Matthew's baseball caps	$0.25 \times m$, or $0.25m$
Half **of** the boys	$\frac{1}{2} \times b$, or $\frac{1}{2}b$
The **product** of two numbers is 12.	$a \times b = 12$, or $ab = 12$

Notice that it isn't necessary to write the times symbol ($\times$) when multiplying by an unknown.

DIVIDE **key word: per**

English	Math
15 blips per 2 bloops	$\frac{15 \text{ blips}}{2 \text{ bloops}}$
60 miles per hour	$\frac{60 \text{ miles}}{1 \text{ hour}}$
22 miles per gallon	$\frac{22 \text{ miles}}{1 \text{ gallon}}$

Order of Operations

Whole numbers are made up of ten digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. In this lesson, you will work only with whole numbers. In later lessons, you will learn specific ways to deal with numbers that come in between whole numbers. These numbers include 6.5, $\frac{1}{2}$, 34.6, $\frac{2}{3}$, and so on.

SOLVING PROBLEMS WITH MULTIPLE STEPS

You are familiar with the four basic *operations*, or ways of calculating: adding, subtracting, multiplying, and dividing. Sometimes a problem will ask you to do more than one operation. For example, if you are asked to solve this problem, what should you do?

$8 \times 3 + 20 \div 4 =$

You could do the operations in order from left to right. That is, you could multiply ($8 \times 3 = 24$), add ($24 + 20 = 44$), then divide ($44 \div 4 = 11$) to get 11. But you would not get the correct answer. The correct answer is 29. It looks tricky, but it's not if you know the *order of operations*. The order of operations involves three simple steps. When you follow these steps, you will get the correct answer.

THE ORDER OF OPERATIONS

Step 1: Do all the operations in parentheses.
Step 2: Multiply and divide numbers in order from left to right.
Step 3: Add and subtract numbers in order from left to right.

Example: $2 + 5 - (9 \div 3) \times 2 =$
To solve this problem, you should follow the steps in the table above.

Step 1: Do the operations in parentheses first.
$2 + 5 - (9 \div 3) \times 2 =$
$2 + 5 - (3) \times 2 =$
Step 2: Multiply.
$2 + 5 - 6 =$
Step 3: Add and subtract numbers in order, from left to right.
$7 - 6 = 1$

If you have a series of numbers to add or multiply, the order will not affect your final answer. You can group the numbers in a way that makes the addition or multiplication easier.

Examples:

$3 + 6 = 6 + 3$

$9 \times 2 = 2 \times 9$

$(2 + 3) + 5 = 2 + (3 + 5)$

$4 \times (6 \times 8) = (4 \times 6) \times 8$

So, if you were asked to solve the following problem

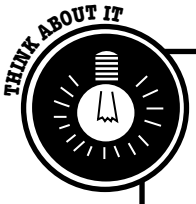
$27 + 5 + 3 + 15 =$

you might group 27 + 3 and 5 + 15 to make the math easier and faster. Do you see how grouping can make a problem easier? How could you group the numbers in the following problem to make it easier?

$12 \times 7 \times 5 =$

If you know that 12×5 is 60, you could do this calculation first. Then calculate 60×7 (420). Notice that if you did 12×7 first, then you would end with 84×5, which isn't as quick to calculate at 60×7. Regrouping the numbers can speed up your calculations.

Keep in mind that *all* of the operations in the series must be *either* addition *or* multiplication for this shortcut to work. Also, remember that the order of the numbers in subtraction and division *is* important. You cannot change the order of subtraction and division numbers and still get the correct answer.



What if the question had asked: How much did the two girls pay altogether? How would you write the problem in math symbols to answer this question? There is more than one way to write it. Here are some ways you might recognize:

$2 \times (6.25 + 2) + 4.50 =$

$2 \times 6.25 + 4.50 + 2 \times 2 =$

$2 \times (6.25 + (4.50 \div 2) + 2) =$

Order of Operations

Practice

Solve the following problems using the order of operations.

1. $(8 + 2) - 3 \times 2 =$
2. $9 \times 5 + 3 \div 1 =$
3. $(3 + 4) \times (2 + 6) =$
4. $(8 + 12) + (6 \div 2) =$
5. $9 \div 3 + 7 =$
6. $9 \times 7 + 8 \div 4 =$
7. $6 \times (5 + 2) - 1 =$
8. $(10 \times 4) + 12 - 6 =$
9. $(9 + 3) \times (18 \div 3) =$
10. $(18 + 6) \div (18 - 12) =$
11. $5 \times 7 + 16 \div 4 =$
12. $12 + 8 - (20 \times 2) \div 10 =$
13. $3 \times 9 - 15 \div 5 =$
14. $14 - 1 - 4 \div 2 =$
15. $12 + 4 \div 4 \times 4 + 7 =$
16. $(13 + 2) \div 3 + 2 =$
17. $11 + 5 + 4 \times 3 + 7 =$
18. $8 \times 6 + 10 \div 2 =$
19. $4 \times 10 - 7 + 17 + 7 \times 2 =$
20. $8 \times 4 + 21 \div 3 - 7 + 9 - 1$

Practice

Translate each problem into math symbols. Then use the order of operations to solve each problem.

21. Add 30 and 45. Then divide by 5.
22. Divide 81 by 9. THen multiply the quotient by 9.
23. Multiply 9 and 6. Then add 12 to the product.
24. Add the difference of 7 and 3 to the product of 2 and 8.
25. Add 12 and 4. Then multiply by 8.
26. Divide 42 by 6. Then find the difference between the quotient and 3.
27. Multiply the sum of 3 and 7 by the sum of 2 and 8.
28. Divide the sum of 15 and 5 by the product of 2 and 5.

Order of Operations

CHOOSING AN OPERATION

Often a problem will tell you exactly which operation you should do. However, sometimes you will have to translate the words in a word problem into the operations. Look for these clues when you have to choose the operations.

You add (+) when you are asked to

- find a sum
- find a total
- combine amounts

Key words to look for:

- sum
- total
- altogether

You subtract (–) when you are asked to

- find a difference
- take away an amount
- compare quantities

Key words to look for:

- difference
- take away
- how many more than
- how much less than
- how many fewer than
- how much is left over

You multiply (×, ·) when you are asked to

- find a product
- add the same number over and over

Key words to look for:

- product
- times

You divide (÷) when you are asked to

- find a quotient
- split an amount into equal parts

Key words to look for:

- quotient
- per

Order of Operations

Example: Add the product of 6 and 3 to the sum of 10 and 4.
To solve this problem, begin by translating the words into math symbols. You know from the lists on the previous page and above on this page that the word *product* means to multiply. So you will need to multiply 6 and 3. You also know that *sum* means to add. Thus, you could write the problem like this:

$6 \times 3 + 10 + 4 =$

Now follow the order of operations to solve the problem you have written:

Step 1: There are no parentheses. Skip to Step 2.
Step 2: Multiply.
$6 \times 3 + 10 + 4 =$
$18 + 10 + 4 =$
Step 3: Add in order from left to right.
$28 + 4 = 32$

Example: Elsa and Thuy went to a movie at the cinema. They shared a large popcorn. Each girl paid for her own drink. The movie cost $6.25. The popcorn cost $4.50. Each drink cost $2. How much did each girl pay?

Begin by translating the words into math symbols. The cost of the popcorn should be divided between the two girls. So, each girl paid

$6.25 + (4.50 \div 2) + 2 =$

Now solve the problem following the order of operations.

Step 1: Do operations in parentheses first.
$6.25 + (2.25) + 2 =$
Step 2: There is no multiplication or division. Skip to Step 3.
Step 3: Add.
$8.5 + 2 = 10.50$

Each girl paid $10.50 for the movie and food.

Order of Operations

Simplify the Expression

1. $3 \times (2 \times 4^3) \div 4$
2. $(4^3 + 2 - 1)$
3. $(5 \times 3) \times 1 + 5$
4. $(7^2 - 2^3 - 6)$
5. $(5^3 + 7) \times 2$
6. $4 - (9 + 2^2 \div 2)$
7. $6 - (9 + 8^2 \times 1^3) + 5$
8. $(2 \div 4 \times 8)$
9. $8 - (3 + 4^3) \times 5$
10. $5 \times (2^3 - 8) \times 5$
11. $(9 \times 9 + 5)$
12. $(1 + 4 - 4)$
13. $5 \times (4 \div 1^2 + 8)$
14. $(5 - 8^2 + 6 - 1)$
15. $2^2 \div (6 \div 9) - 5$
16. $(3 + 1^2 + 4)$
17. $1^3 - (2 + 3 + 7) \times 5$
18. $3 \times (2^3 + 5) + 2$
19. $9 \times (2^3 \div 4 \times 5)$
20. $(8 + 7 + 2 - 9)$

Order of Operations

Simplify the Expression

1. $3 - (2^3 \div 1) + 5$
2. $(6^3 - 9 - 1)$
3. $(5 + 7^3) \div 7 \times 7$
4. $(2 - 7) - 8 - 3$
5. $(6 + 7^2) + 1$
6. $4^3 - (2 + 2^3) \times 5$
7. $(6 - 1 + 7)$
8. $(3^2 - 3^2) + 5$
9. $(7 + 8 - 4^2) \times 2 + 1$
10. $6 - (8 + 3^3) - 4$
11. $(3 + 3 \times 6 + 3^2 - 3)$
12. $(7 + 2^3) \times 9$
13. $(3 \times 6) - 5$
14. $6 \times (2 \div 1) \div 1$
15. $(2^3 - 9 - 8) \div 3 \times 3$
16. $2^3 \div (7 \div 7 \div 8)$
17. $(6 + 6^2) \times 3$
18. $(3 + 1) \times 8 \times 4$
19. $(7^3 \times 4) + 7$
20. $6^2 - 3 \times (3^2 \times 2) + 5$

Order of Operations

Simplify the Expression

1. $4^2 + (1 \times 5 + 7^2) + 8$
2. $6^2 \div (2 - 8) + 1 - 8$
3. $(6^2 \times 7) \div 2$
4. $9 - (5^2 + 7) \div 2$
5. $(6 + 8 - 2)$
6. $(1 - 4^2) \times 2$
7. $5 + (4^3 + 1) + 8$
8. $(4 + 8) + 1$
9. $(2^2 + 9 \div 1)$
10. $(3 + 8 - 1)$
11. $3^2 + 9^2 - (8 + 7) \div 5$
12. $2 + 3 \times (8 + 5^3 \div 1)$
13. $(3^2 \times 3 + 4 + 2) - 1$
14. $(4^3 \times 3^2 \div 4)$
15. $(9 \times 9^3 + 4)$
16. $5 - 9 + (7 \times 2^2 - 8)$
17. $(8 - 3^2) - 8$
18. $(5^3 + 3 - 2^3 + 6 - 8)$
19. $(2 \times 5 \div 5)$
20. $(1^2 \times 7) \times (8^2 - 8) \times 1$

Order of Operations

Simplify the Expression

1. $(2^3 + 5 \times 8)$
2. $(2 \times 6^3 + 6^3 \times 1^2 + 2)$
3. $(4 \div 1) \times 1$
4. $(6 \times 3) \times 7$
5. $(6 - 5^2) + 3^3 \times 2$
6. $(1 - 6 - 3)$
7. $5^2 + 9 + (2^2 \times 1^3 \times 5)$
8. $(7^2 \div 1 - 8) + 7^3 + 4$
9. $(9^2 - 3) + 9$
10. $(3^3 + 9) \times (1 + 9 - 2)$
11. $9 + 9 + (6^2 - 6) \times 4$
12. $5 - (3 - 3) + 6^3 \div 1$
13. $6 + 1 \times (9 - 4) + 6$
14. $(6 \div 6) \times (2^2 + 8) \div 1$
15. $(2^2 \times 4 \times 3)$
16. $(1^3 - 6) \div 5$
17. $(7 - 2^2 + 3)$
18. $4^3 \times (6 + 8) \div 1$
19. $4 \times (9^2 \div 6 \times 5)$
20. $(5 \times 8^2) + 9$

Order of Operations

Simplify the Expression

1. $(7 - 5^3) + 5$
2. $7^3 + (8 \div 1^2 - 5)$
3. $(9^2 \times 4 - 6)$
4. $(5^2 \times 2^2 - 8)$
5. $(9 - 5) \div (8 \div 8) + 1$
6. $1^2 + (1^2 - 5^2) + 9$
7. $(4^2 - 1^3) \times (5 - 9 - 6)$
8. $(1 + 2^3 \div 4) + 5^3 + 8$
9. $(1^2 \div 1) - 9 - 4$
10. $(2^3 + 6^2 - 3^2 + 9 \times 3)$
11. $(7 \times 4^3 + 1) + 9 \times 8$
12. $(1^2 \div 1 + 6)$
13. $4^2 - (9 \times 7^3) - 4^3 + 8$
14. $3 - 2^2 - (7^3 + 2^2) + 6$
15. $5 - (6 + 2^2) + 9^2 - 2$
16. $9^3 + (5^2 + 6 \div 2)$
17. $9 + (4 \times 4^2 - 4)$
18. $(7 + 1) + 2$
19. $1 + (9 + 6) + 3$
20. $(4^3 - 9 + 4)$

Order of Operations

Simplify the Expression

1. $(3^3 + 7) - 1$
2. $(2^3 - 5^2 \times 7^3) + 1$
3. $8^3 \times (2^2 + 7 - 7) + 5$
4. $4 + (9^2 - 7) \times 7$
5. $(9^2 + 5) - 8^3 + 1$
6. $(4^2 \times 2^2 \div 8)$
7. $(2 \times 7 \times 8)$
8. $(5 \times 9 \times 1^2) \div 5 \times 2$
9. $(8^3 - 2^2) \times 3$
10. $(3 + 5) + 8$
11. $5^3 \div (7^3 \div 7^3) \times 6$
12. $(5 \times 3 + 4^2) + 2$
13. $(5 + 9^2 \times 2^2) - 9 \times 7$
14. $(1 - 5) - 9^2 + 2$
15. $6 + (7^3 \div 7) - 6 - 3$
16. $(3 + 4^2 + 8)$
17. $8^2 \times (1 \times 1^3 - 9 \times 8)$
18. $(8 - 6 + 9) + 3 - 6$
19. $3 \times (7 - 6) \times 7$
20. $(3^2 + 8^2 + 9)$

Order of Operations

Simplify the Expression

$(7 - 3^3) - 5 - 9 =$

$(3^3 \times 3) - 5 - 8 =$

$6^2 - (6 \times 7 \times 5) =$

$(2^2 - 7^2) - (8 \div 4) \times 7 =$

$(5 \times 3^2 + 6) =$

$(6 - 5) - 8 \div 2 =$

$(3 \times 5 \times 7) =$

$(3 \times 5) \times 5 =$

$6 + 5 + (9 \div 3^3 \times 7) =$

$3 \times (2 \times 3 \times 2) =$

Order of Operations

Simplify the Expression

$3^3 + 10 \times 3 =$

$(4^3 + 4 \times 3) \div 2 - 3 =$

$4 \times (3 \div 24 \times 64) - 8 =$

$3 \times [5^2 \times (3^2 - 1)] =$

$(2^3 - 16 \div 2) \times 3 =$

Order of Operations

Simplify the Expression

$4^2 + 15 \times 2 =$

$(3^3 + 5 \times 3) \div 2 - 3 =$

$3 \times (4 \div 24 \times 42) - 8 =$

$2 \times [5^2 \times (4^2 - 3)] =$

$(3^3 - 16 \div 2) \times 3 =$

Order of Operations

Practice Test #2

1. Which of the following is the same as 17+ 23?
   A. 17 x 23
   B. 23 x 17
   C. 23 + 17
   D. 17 – 23

2. Which of the following is the same as (4 x 20) – (4 x 7)?
   A. 4 – (20 x 7)
   B. 4 x 20 x 7
   C. 4 x 20 – 7
   D. 4(20 – 7)

3. Which of the following is **not** equal to 7(8 – 4)?
   A. 56 – 7 x 4
   B. 7 x 8 – 4
   C. 7 x 8 – 7 x 4
   D. 7 x 4

Complete each exercise by applying the rules for order of operations.

4. $3^2 \times 4^3$
   A. 576
   B. 765
   C. 35
   D. 72

5. $27 - 256 \div 4^3$
   A. 32
   B. 23
   C. 56
   D. 35

6. An agent charges $150 per gig to book a rock band, plus $75 per month for travel expenses. What was his monthly fee if he booked 6 gigs for the band last month?
   A. $900
   B. $600
   C. $11,250
   D. $975

7. Six people in a club will share the expenses of a party that costs $240. How much will Katie pay for her share of the party if the club owes her $8?
   A. $40
   B. $32
   C. $24
   D. $38

8. Jesse spends $5 a day on lunch. Which algebraic expression correctly represents the amount of money he will spend on lunch in x days?
   A. x – 5
   B. 5x
   C. 5+x
   D. $x^5 + 5$

Order of Operations

Practice Test #2

9. Which algebraic expression correctly represents this phrase?
The quotient of twelve and seven times a number, decreased by five.
   A. $\frac{12}{7N} - 5$
   B. $5 - \frac{12}{7N}$
   C. $5 - \frac{7}{12N}$
   d. $\frac{12N - 5}{7}$

10. Which algebraic equation correctly represents this sentence?
A number increased by eight is nineteen.
   A. 19 – y = 8
   B. 19 + y = 8
   C. y+ 8 = 19
   D. 19y = y - 8

11. 6 + 8 x 4
   A. 32
   B. 36
   C. 38
   D. 56

12. (10 + 9) x 5
   A. 95
   B. 89
   C. 50
   D. 59

13. 4 + 7 x 6 + 9
   A. 55
   B. 50
   C. 48
   D. 165

14. $6(5+3)^2$
   A. 384
   B. 364
   C. 264
   D. 2304

15. $15 - 3 + 2^3$
   A. 20
   B. 4
   C. 14
   D. 22

16. $\frac{6 + 8 + 7}{3}$
   A. 21
   B. 7
   C. 17
   D. 11

17. 6 + 9 x 4 + 5
   A. 74
   B. 135
   C. 47
   D. 87

18. 45 + 8 x 4
   A. 53
   B. 212
   C. 57
   D. 77

19. 9 + 40 ÷ 8 + 6
   A. 20
   B. 3.5
   C. c.12
   D. 9.35

20. $6(7+2)^3$
   A. 2916
   B. 162
   C. c.4374
   D. 90

Solving Algebraic Expressions

Substitute the numbers for the letters, and simplify to one number

Variable Values	
$a = 3$	$y = \frac{1}{2}$
$b = -5$	$z = -8$
$x = 6$	

1. ◯ $4a + z$
2. ◯ $3x \div z$
3. ◯ $2ax - z$
4. ◯ $5ab + xy$
5. ◯ $4b^2 - az$
6. ◯ $7x \div 2yz$
7. ◯ $bx + z \div y$
8. ◯ $6b - 2ab$
9. ◯ $a(b + z)^2$
10. ◯ $2(a^2 + 2y) \div b$
11. ◯ $a^3 + 24y - 3b$
12. ◯ $-2x - b + az$
13. ◯ $5z^2 - 2z + 2$
14. ◯ $5xy \div 2b$
15. ◯ $7x + \frac{12}{x} - z$
16. ◯ $2b^2 \div y$
17. ◯ $bx(z + 3)$
18. ◯ $6y(z + y) + 3ab$
19. ◯ $2bx + (z - b)$
20. ◯ $12ab + y$
21. ◯ $y\left[\left(\frac{x}{2} - 3\right) - 4a\right]$
22. ◯ $10b^3 - 4b^2$
23. ◯ $8y(a^3 - 2y)$
24. ◯ $z^2 - 4a^2y$
25. ◯ $3x^2b(5a - 3b)$

Solving Algebraic Expressions — A

Substitute the numbers for the letters, and simplify to one number

Variable Values	
$a = 2$	$y = -1$
$b = -1$	$z = 3$
$x = 3$	

1. $4a + z$
2. $3x \div z$
3. $2ax - z$
4. $5ab + xy$
5. $4b^2 - az$
6. $7x \div 2yz$
7. $bx + z \div y$
8. $6b - 2ab$
9. $a(b + z)^2$
10. $2(a^2 + 2y) \div b$
11. $a^3 + 24y - 3b$
12. $-2x - b + az$
13. $5z^2 - 2z + 2$
14. $5xy \div 2b$
15. $7x + \frac{12}{x} - z$
16. $2b^2 \div y$
17. $bx(z + 3)$
18. $6y(z + y) + 3ab$
19. $2bx + (z - b)$
20. $12ab + y$
21. $y\left[\left(\frac{x}{2} - 3\right) - 4a\right]$
22. $10b^3 - 4b^2$
23. $8y(a^3 - 2y)$
24. $z^2 - 4a^2y$
25. $3x^2b(5a - 3b)$

Solving Algebraic Expressions — B

Substitute the numbers for the letters, and simplify to one number

Variable Values	
$a = 2$	$y = -1$
$b = -2$	$z = 1$
$x = 6$	

1. ☐ $4a + z$
2. ☐ $3x \div z$
3. ☐ $2ax - z$
4. ☐ $5ab + xy$
5. ☐ $4b^2 - az$
6. ☐ $7x \div 2yz$
7. ☐ $bx + z \div y$
8. ☐ $6b - 2ab$
9. ☐ $a(b + z)^2$
10. ☐ $2(a^2 + 2y) \div b$
11. ☐ $a^3 + 24y - 3b$
12. ☐ $-2x - b + az$
13. ☐ $5z^2 - 2z + 2$
14. ☐ $5xy \div 2b$
15. ☐ $7x + \frac{12}{x} - z$
16. ☐ $2b^2 \div y$
17. ☐ $bx(z + 3)$
18. ☐ $6y(z + y) + 3ab$
19. ☐ $2bx + (z - b)$
20. ☐ $12ab + y$
21. ☐ $y\left[\left(\frac{x}{2} - 3\right) - 4a\right]$
22. ☐ $10b^3 - 4b^2$
23. ☐ $8y(a^3 - 2y)$
24. ☐ $z^2 - 4a^2y$
25. ☐ $3x^2b(5a - 3b)$

Solving Algebraic Expressions — C

Substitute the numbers for the letters, and simplify to one number

Variable Values	
$a = -2$	$y = -1$
$b = -1$	$z = -1$
$x = 6$	

1. $4a + z$
2. $3x \div z$
3. $2ax - z$
4. $5ab + xy$
5. $4b^2 - az$
6. $7x \div 2yz$
7. $bx + z \div y$
8. $6b - 2ab$
9. $a(b + z)^2$
10. $2(a^2 + 2y) \div b$
11. $a^3 + 24y - 3b$
12. $-2x - b + az$
13. $5z^2 - 2z + 2$
14. $5xy \div 2b$
15. $7x + \frac{12}{x} - z$
16. $2b^2 \div y$
17. $bx(z + 3)$
18. $6y(z + y) + 3ab$
19. $2bx + (z - b)$
20. $12ab + y$
21. $y\left[\left(\frac{x}{2} - 3\right) - 4a\right]$
22. $10b^3 - 4b^2$
23. $8y(a^3 - 2y)$
24. $z^2 - 4a^2y$
25. $3x^2b(5a - 3b)$

Solving Algebraic Expressions — D

Substitute the numbers for the letters, and simplify to one number

Variable Values	
$a = -1$	$y = 1$
$b = -2$	$z = 1$
$x = 6$	

1. $4a + z$
2. $3x \div z$
3. $2ax - z$
4. $5ab + xy$
5. $4b^2 - az$
6. $7x \div 2yz$
7. $bx + z \div y$
8. $6b - 2ab$
9. $a(b + z)^2$
10. $2(a^2 + 2y) \div b$
11. $a^3 + 24y - 3b$
12. $-2x - b + az$
13. $5z^2 - 2z + 2$
14. $5xy \div 2b$
15. $7x + \frac{12}{x} - z$
16. $2b^2 \div y$
17. $bx(z + 3)$
18. $6y(z + y) + 3ab$
19. $2bx + (z - b)$
20. $12ab + y$
21. $y\left[\left(\frac{x}{2} - 3\right) - 4a\right]$
22. $10b^3 - 4b^2$
23. $8y(a^3 - 2y)$
24. $z^2 - 4a^2y$
25. $3x^2b(5a - 3b)$

Solving Algebraic Expressions — E

Substitute the numbers for the letters, and simplify to one number

Variable Values	
$a = 2$	$y = -1$
$b = -2$	$z = -1$
$x = 6$	

1. $4a + z$
2. $3x \div z$
3. $2ax - z$
4. $5ab + xy$
5. $4b^2 - az$
6. $7x \div 2yz$
7. $bx + z \div y$
8. $6b - 2ab$
9. $a(b + z)^2$
10. $2(a^2 + 2y) \div b$
11. $a^3 + 24y - 3b$
12. $-2x - b + az$
13. $5z^2 - 2z + 2$
14. $5xy \div 2b$
15. $7x + \frac{12}{x} - z$
16. $2b^2 \div y$
17. $bx(z + 3)$
18. $6y(z + y) + 3ab$
19. $2bx + (z - b)$
20. $12ab + y$
21. $y\left[\left(\frac{x}{2} - 3\right) - 4a\right]$
22. $10b^3 - 4b^2$
23. $8y(a^3 - 2y)$
24. $z^2 - 4a^2y$
25. $3x^2b(5a - 3b)$

Solving Algebraic Expressions — F

Substitute the numbers for the letters, and simplify to one number

Variable Values	
$a = -1$	$y = 1$
$b = 2$	$z = 3$
$x = 6$	

1. $4a + z$
2. $3x \div z$
3. $2ax - z$
4. $5ab + xy$
5. $4b^2 - az$
6. $7x \div 2yz$
7. $bx + z \div y$
8. $6b - 2ab$
9. $a(b + z)^2$
10. $2(a^2 + 2y) \div b$
11. $a^3 + 24y - 3b$
12. $-2x - b + az$
13. $5z^2 - 2z + 2$
14. $5xy \div 2b$
15. $7x + \frac{12}{x} - z$
16. $2b^2 \div y$
17. $bx(z + 3)$
18. $6y(z + y) + 3ab$
19. $2bx + (z - b)$
20. $12ab + y$
21. $y\left[\left(\frac{x}{2} - 3\right) - 4a\right]$
22. $10b^3 - 4b^2$
23. $8y(a^3 - 2y)$
24. $z^2 - 4a^2y$
25. $3x^2b(5a - 3b)$

Practice Test #1

	A	B	C	D	E
1	○	○	○	○	○
2	○	○	○	○	○
3	○	○	○	○	○
4	○	○	○	○	○
5	○	○	○	○	○
6	○	○	○	○	○
7	○	○	○	○	○
8	○	○	○	○	○
9	○	○	○	○	○
10	○	○	○	○	○
11	○	○	○	○	○
12	○	○	○	○	○
13	○	○	○	○	○
14	○	○	○	○	○
15	○	○	○	○	○
16	○	○	○	○	○
17	○	○	○	○	○
18	○	○	○	○	○
19	○	○	○	○	○
20	○	○	○	○	○

Practice Test #2

	A	B	C	D	E
1	○	○	○	○	○
2	○	○	○	○	○
3	○	○	○	○	○
4	○	○	○	○	○
5	○	○	○	○	○
6	○	○	○	○	○
7	○	○	○	○	○
8	○	○	○	○	○
9	○	○	○	○	○
10	○	○	○	○	○
11	○	○	○	○	○
12	○	○	○	○	○
13	○	○	○	○	○
14	○	○	○	○	○
15	○	○	○	○	○
16	○	○	○	○	○
17	○	○	○	○	○
18	○	○	○	○	○
19	○	○	○	○	○
20	○	○	○	○	○

Module #3:
Variables

Solve for the Unknown

Section A

(1) $3x + 1 = 10$

(2) $4y + 3 = 11$

(3) $2a - 5 = 7$

(4) $5m - 6 = 9$

(5) $5 = 4x + 9$

(6) $2 = 5b + 12$

(7) $2x - 5 = -11$

(8) $3n - 7 = -19$

(9) $4 - 3w = -2$

(10) $5 - 6x = -13$

(11) $8 - 3t = 2$

(12) $12 - 5x = 7$

(13) $4a - 20 = 0$

(14) $3y - 9 = 0$

(15) $6 + 2b = 0$

(16) $10 + 5m = 0$

(17) $-2x + 5 = -7$

(18) $-5d + 3 = -12$

Solve for the Unknown

(19) $-12x + 30 = -6$

(20) $-13 = -11y + 9$

(21) $2 = 7 - 5a$

(22) $3 = 11 - 4n$

(23) $-35 = -6b + 1$

(24) $-8x + 3 = -29$

(25) $-3m - 21 = 0$

(26) $-5x - 30 = 0$

(27) $-4y + 15 = 15$

(28) $-3x + 19 = 19$

(29) $9 - 4x = 6$

(30) $3t - 2 = 0$

(31) $9x - 4 = 0$

(32) $7 - 8z = 0$

(33) $1 - 3x = 0$

(34) $9d + 10 = 7$

(35) $12w + 11 = 5$

(36) $6y - 5 = -7$

(37) $8b - 3 = -9$

(38) $5 - 6m = 2$

Solve for the Unknown

(39) $7 - 9a = 4$

(40) $9 = -12c + 5$

(41) $0 = -18x + 7$

(42) $2y + \frac{1}{3} = \frac{7}{3}$

(43) $4a + \frac{3}{4} = \frac{19}{4}$

(44) $2n - \frac{3}{4} = \frac{13}{4}$

(45) $3x - \frac{5}{6} = \frac{13}{6}$

(46) $5y + \frac{3}{7} = \frac{3}{7}$

(47) $9x + \frac{4}{5} = \frac{4}{5}$

(48) $8 = 7d - 1$

(49) $8 = 10x - 5$

(50) $4 = 7 - 2w$

(51) $7 = 9 - 5a$

(52) $8t + 13 = 3$

(53) $12x + 19 = 3$

(54) $-6y + 5 = 13$

(55) $-4x + 3 = 9$

Solve for the Unknown

Section B

(56) $\frac{1}{2}a - 3 = 1$

(57) $\frac{1}{3}m - 1 = 5$

(58) $\frac{2}{5}y + 4 = 6$

(59) $\frac{3}{4}n + 7 = 13$

(60) $-\frac{2}{3}x + 1 = 7$

(61) $-\frac{3}{8}b + 4 = 10$

(62) $\frac{x}{4} - 6 = 1$

(63) $\frac{y}{5} - 2 = 3$

(64) $\frac{2x}{3} - 1 = 5$

(65) $\frac{3c}{7} - 1 = 8$

(66) $4 - \frac{3z}{4} = -2$

(67) $3 - \frac{4w}{5} = -9$

(68) $5 + \frac{2y}{3} = 3$

(69) $17 + \frac{5x}{8} = 7$

(70) $17 = 7 - \frac{5t}{6}$

(71) $9 = 3 - \frac{2x}{7}$

(72) $3 = \frac{3a}{4} + 1$

Solve for the Unknown

(73) $7 = \frac{2x}{5} + 4$

(74) $5 - \frac{4c}{7} = 8$

(75) $7 - \frac{5}{9}y = 9$

Section C

(76) $6a + 3 + 2a = 11$

(77) $5y + 9 + 2y = 23$

(78) $7x - 4 - 2x = 6$

(79) $11z - 3 - 7z = 9$

(80) $2x - 6x + 1 = 9$

(81) $b - 8b + 1 = -6$

(82) $3 = 7x + 9 - 4x$

(83) $-1 = 5m + 7 - m$

(84) $8 = 4n - 6 + 3n$

Solve for the Unknown

(85) $8x + 5 = 4x + 13$

(86) $6y + 2 = y + 17$

(87) $5x - 4 = 2x + 5$

(88) $13b - 1 = 4b - 19$

(89) $15x - 2 = 4x - 13$

(90) $7a - 5 = 2a - 20$

(91) $3x + 1 = 11 - 2x$

(92) $n - 2 = 6 - 3n$

(93) $2x - 3 = -11 - 2x$

(94) $4y - 2 = -16 - 3y$

(95) $2b + 3 = 5b + 12$

(96) $m + 4 = 3m + 8$

(97) $4y - 8 = y - 8$

(98) $5a + 7 = 2a + 7$

(99) $6 - 5x = 8 - 3x$

(100) $10 - 4n = 16 - n$

(101) $5 + 7x = 11 + 9x$

(102) $3 - 2y = 15 + 4y$

(103) $2x - 4 = 6x$

(104) $2b - 10 = 7b$

Solve for the Unknown

(105) $8m = 3m + 20$

(106) $9y = 5y + 16$

(107) $8b + 5 = 5b + 7$

(108) $6y - 1 = 2y + 2$

(109) $7x - 8 = x - 3$

(110) $2y - 7 = -1 - 2y$

(111) $2m - 1 = -6m + 5$

Section D

(112) $5x + 2(x + 1) = 23$

(113) $6y + 2(2y + 3) = 16$

(114) $9n - 3(2n - 1) = 15$

(115) $12x - 2(4x - 6) = 28$

(116) $7a - (3a - 4) = 12$

(117) $9m - 4(2m - 3) = 11$

(118) $5(3 - 2y) + 4y = 3$

(119) $4(1 - 3x) + 7x = 9$

(120) $5y - 3 = 7 + 4(y - 2)$

Solve for the Unknown

(121) $5 + 2(3b + 1) = 3b + 5$

(122) $6 - 4(3a - 2) = 2(a + 5)$

(123) $7 - 3(2a - 5) = 3a + 10$

(124) $2a - 5 = 4(3a + 1) - 2$

(125) $5 - (9 - 6x) = 2x - 2$

(126) $7 - (5 - 8x) = 4x + 3$

(127) $3[2 - 4(y - 1)] = 3(2y + 8)$

(128) $5[2 - (2x - 4)] = 2(5 - 3x)$

(129) $3a + 2[2 + 3(a - 1)] = 2(3a + 4)$

(130) $5 + 3[1 + 2(2x - 3)] = 6(x + 5)$

(131) $-2[4 - (3b + 2)] = 5 - 2(3b + 6)$

(132) $-4[x - 2(2x - 3)] + 1 = 2x - 3$

Solve for the Unknown

Isolate x, in terms of y

1. y = 5x
2. y = -7x
3. y = 12x
4. y = 1/2 x
5. y = x/6
6. y = -x/4
7. y = x - 6
8. y = 10 + x
9. y = -4 - x
10. y = 2x + 2
11. y = 3x - 3
12. y = 1/2 x + 4
13. y = -1/4 x - 6
14. y = 4 - 4x
15. y = -6 + 2x
16. y = 8 - 1/2 x
17. y = -10 - 2x
18. y = -12 + x/6
19. y = 18 - 6x
20. y = -6 - 1/2 x

Tips for Multiplying Polynomials

When multiplying a polynomial by a monomial, you use the distributive property of multiplication to multiply each term in the polynomial by the monomial.

$$a(b + c + d + e) = ab + ac + ad + ae$$

When multiplying a binomial by a binomial, you use the mnemonic FOIL to remind you of the order with which you multiply terms in the binomials.

	$(a + b)(c + d)$
F is for **first**. Multiply the first terms of each binomial.	$([a] + b)([c] + d)$ gives the term ac.
O is for **outer**. Multiply the outer terms of each binomial.	$([a] + b)(c + [d])$ gives the term ad.
I is for **inner**. Multiply the inner terms of each binomial.	$(a + [b])([c] + d)$ gives the term bc.
L is for **last**. Multiply the last terms of each binomial.	$(a + [b])(c + [d])$ gives the term bd.
Then you combine the terms.	$ac + ad + bc + bd$

Multiplying a trinomial by a binomial is relatively easy. You proceed similarly to the way you would when using the distributive property of multiplication. Multiply each term in the trinomial by the first and then the second term in the binomial. Then add the results.

$$(a + b)(c + d + e) = (ac + ad + ae) + (bc + bd + be)$$

Practice

Multiply the following polynomials.

1. $x(5x + 3y - 7)$
2. $2a(5a^2 - 7a + 9)$
3. $4bc(3b^2c + 7b - 9c + 2bc^2 - 8)$
4. $3mn(-4m + 6n + 7mn^2 - 3m^2n)$
5. $4x(9x^3 + \frac{3}{x^2} - x^4 + \frac{6x - 1}{x^2})$
6. $(x + 3)(x + 6)$
7. $(x - 4)(x - 9)$
8. $(2x + 1)(3x - 7)$
9. $(x + 2)(x - 3y)$
10. $(7x + 2y)(2x - 4y)$
11. $(5x + 7)(5x - 7)$
12. $(28x + 7)(\frac{x}{7} - 11)$
13. $(3x^2 + y^2)(x^2 - 2y^2)$
14. $(4 + 2x^2)(9 - 3x)$
15. $(2x^2 + y^2)(x^2 - y^2)$
16. $(x + 2)(3x^2 - 5x + 2)$
17. $(2x - 3)(x3 + 3x^2 - 4x)$
18. $(4a + b)(5a^2 + 2ab - b^2)$
19. $(3y - 7)(6y^2 - 3y + 7)$
20. $(3x + 2)(3x^2 - 2x - 5)$
21. $(x + 2)(2x + 1)(x - 1)$
22. $(3a - 4)(5a + 2)(a + 3)$
23. $(2n - 3)(2n + 3)(n + 4)$
24. $(5r - 7)(3r^4 + 2r^2 + 6)$
25. $(3x^2 + 4)(x - 3)(3x^2 - 4)$

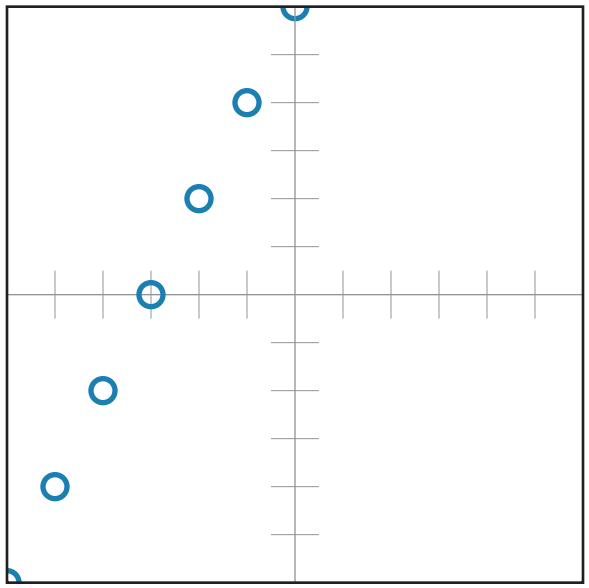
Module #4:
Linear Equations

Four Ways to Define a Line

Data Table

X	Y
-6	-6
-5	-4
-4	-2
-3	0
-2	2
-1	4
0	6

Cartesian Plot



Algebraic Expression

$$Y = 2X + 6$$

slope
m

y-intercept
b

Verbal Expression

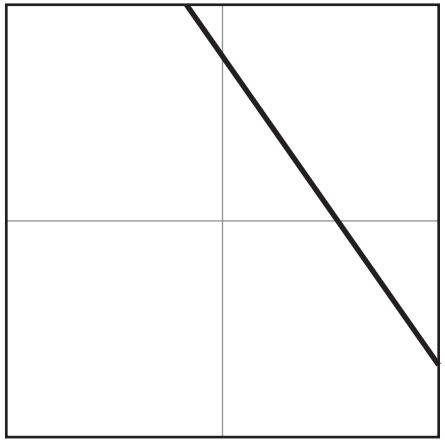
Six more than
two times a number

Eyeballing the y-intercept

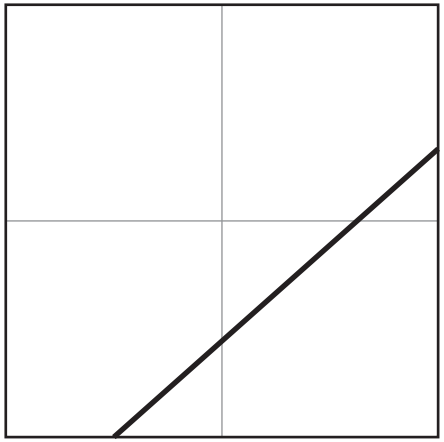
Does the line cross above the X axis? Then the y-intercept is positive.

Does the line cross below the X axis? Then the y-intercept is negative.

b positive

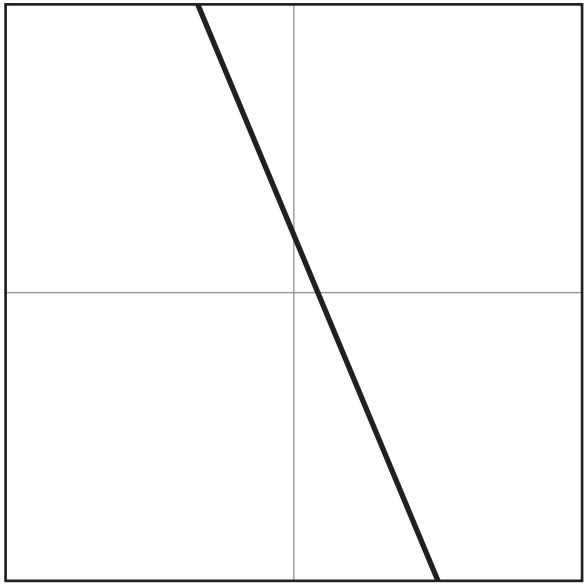


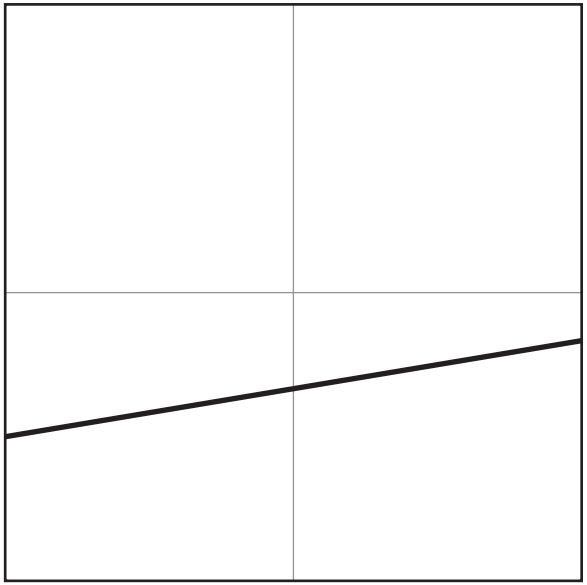
b negative

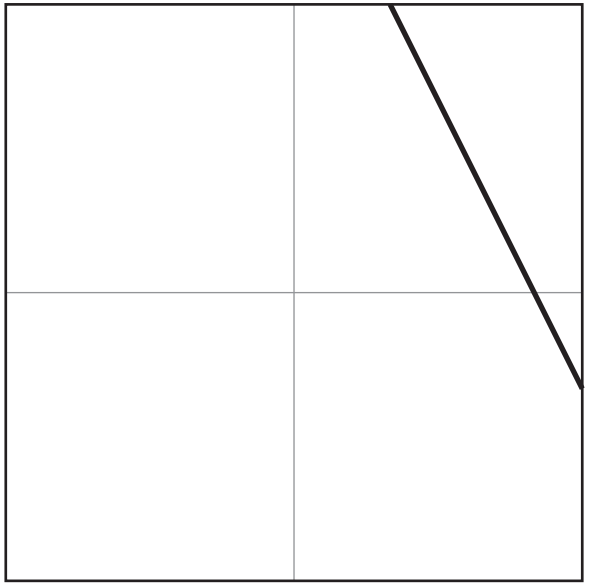


For the three graphs below, answer the following questions:

1) Is the y-intercept positive or negative?
2) Is the y-intercept close to zero, or is it a big number?





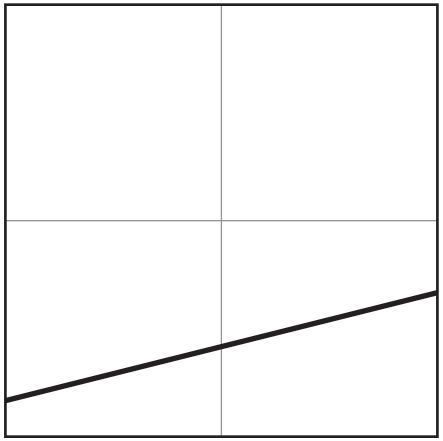


Eyeballing the slope sign

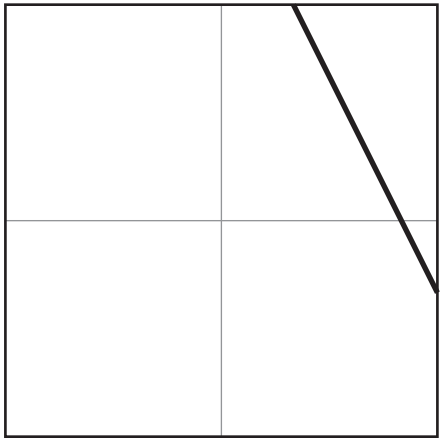
Does the line "slope up," left to right? Then the slope is positive.

If the line "slopes down," left to right, the slope is negative.

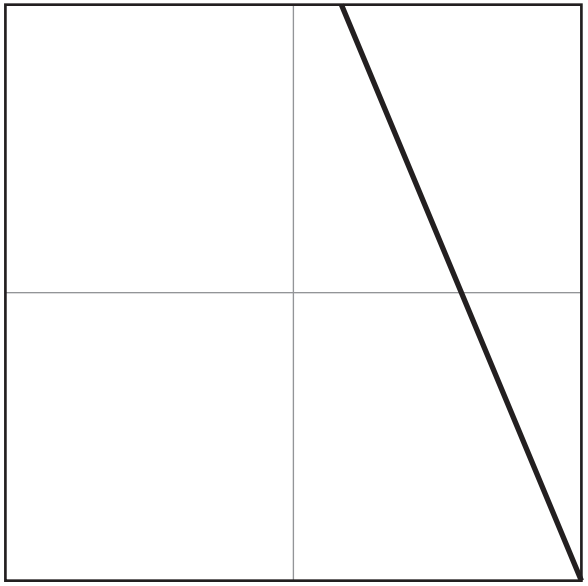
m positive

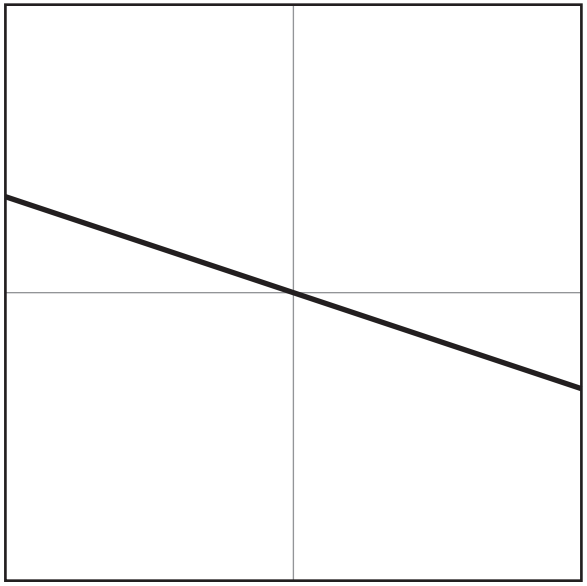


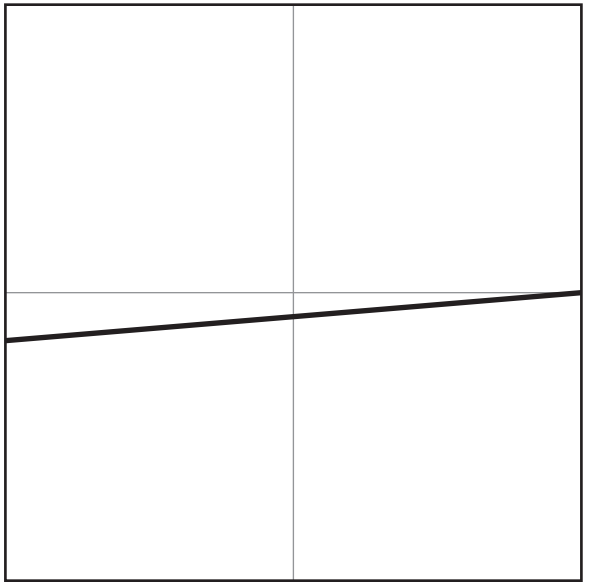
m negative



For the three graphs below, is the slope positive or negative?





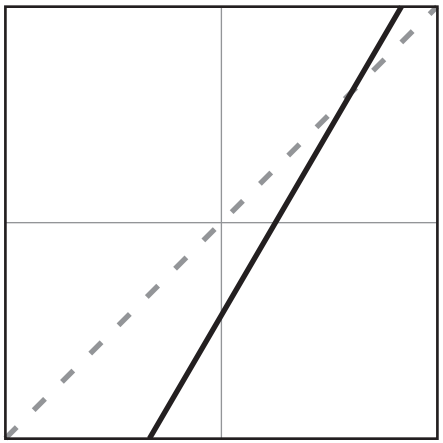


Eyeballing the slope magnitude

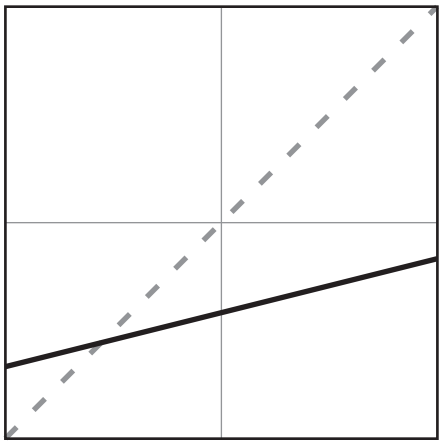
Is the slope positive?
And the line "steep"?
Then the slope is greater than one.

Is the slope positive?
Is the line "flat"?
Then the slope is greater than zero,
but less than one.

$m > 1$

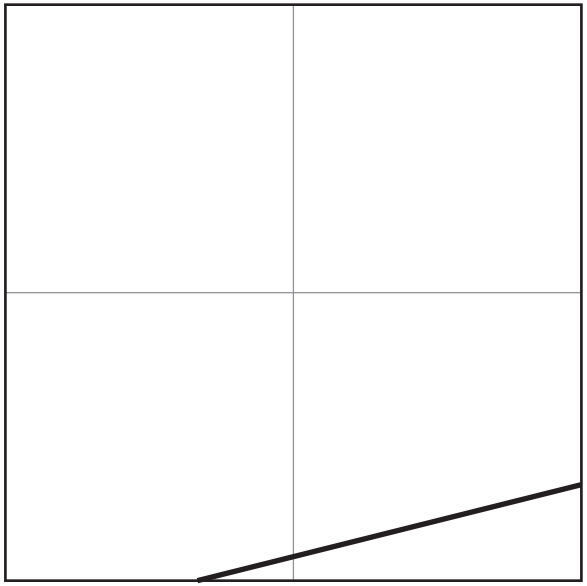


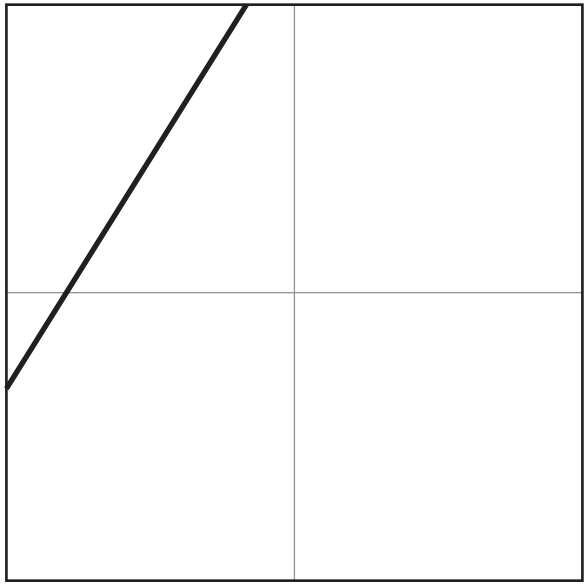
$0 < m < 1$

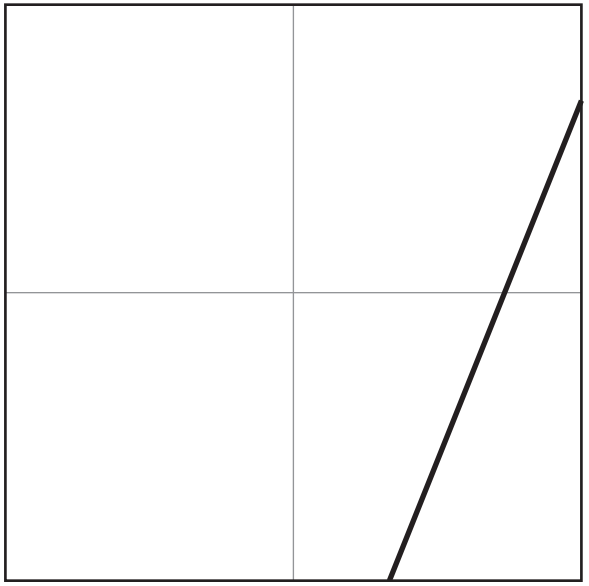


For the three graphs below, answer the following questions:

1) Is the slope positive or negative?
2) Is the slope close to zero, or is it a big number?





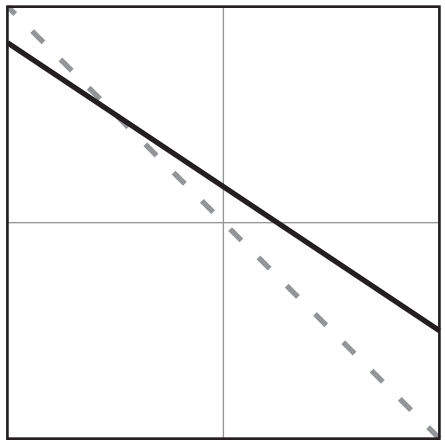


Eyeballing the slope magnitude

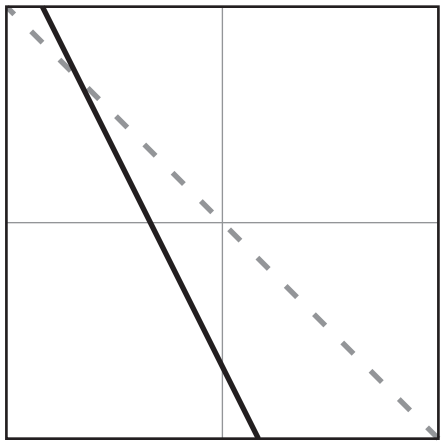
Is the slope negative?
And the line "flat"?
Then the slope must be
less than zero,
but greater than
negative one.

Is the slope negative?
And the line "steep"?
Then the slope is less
than negative one.

$-1 < m < 0$

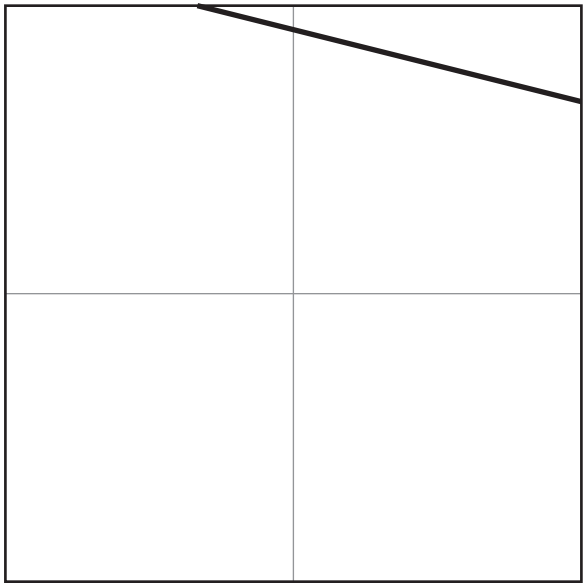


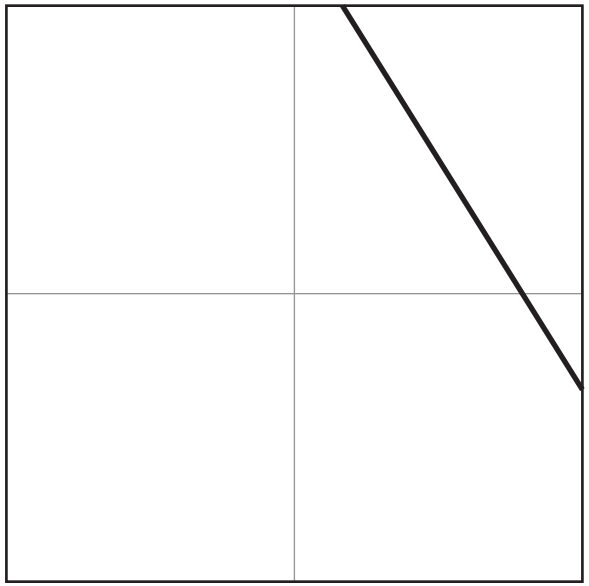
$m < -1$

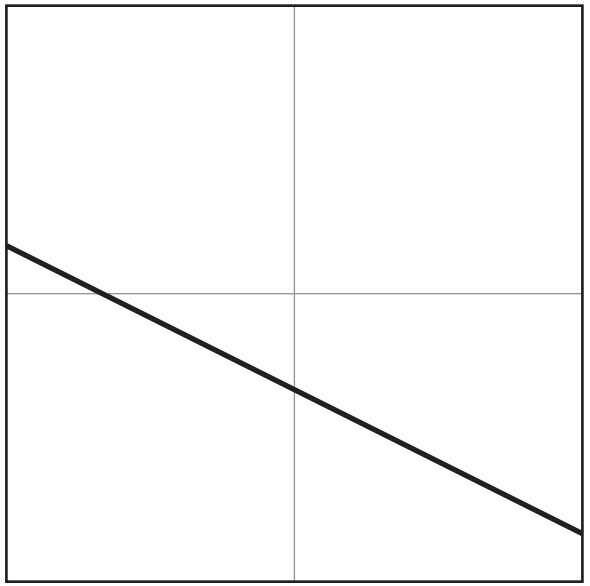


For the three graphs below, answer the following questions:

1) Is the slope positive or negative?
2) Is the slope close to zero, or is it a big number?







Graphing Linear Equations

This chapter asks you to find solutions to linear equations by graphing. The solution of a linear equation is the set of ordered pairs that form a line on a coordinate graph. Every point on the line is a solution for the equation. One method for graphing the solution is to use a table with x and y values that are solutions for the particular equation. You select a value for x and solve for the y value. But in this chapter, we will focus on the slope and y-intercept method.

The slope and y-intercept method may require you to change an equation into the slope-intercept form. That is, the equation with two variables must be written in the form $y = \boldsymbol{m}x + \boldsymbol{b}$. Written in this form, the $\boldsymbol{m}$ value is a number that represents the slope of the solution graph and the $\boldsymbol{b}$ is a number that represents the y-intercept. The slope of a line is the ratio of the change in the y value over the change in the x value from one point on the solution graph to another. From one point to another, the slope is the rise over the run. The y-intercept is the point where the solution graph (line) crosses the y-axis. Another way of saying that is: The y-intercept is the place where the value of x is 0.

Tips for Graphing Linear Equations

- Rewrite the given equation in the form $y = mx + b$.
- Use the $\boldsymbol{b}$ value to determine where the line crosses the y-axis. That is the point $(0,b)$.
- Use the value of $\boldsymbol{m}$ as the slope of the equation. Write the slope as a fraction. If the value of $\boldsymbol{m}$ is a whole number, the slope is the whole number over 1. The value of $\boldsymbol{m}$ is $= \frac{\text{change in } y}{\text{change in } x}$.
- If the value of $\boldsymbol{m}$ is negative, use a negative sign in only the numerator or the denominator, not both. For example, $\frac{-3}{4} = \frac{-3}{4} = \frac{3}{-4}$.

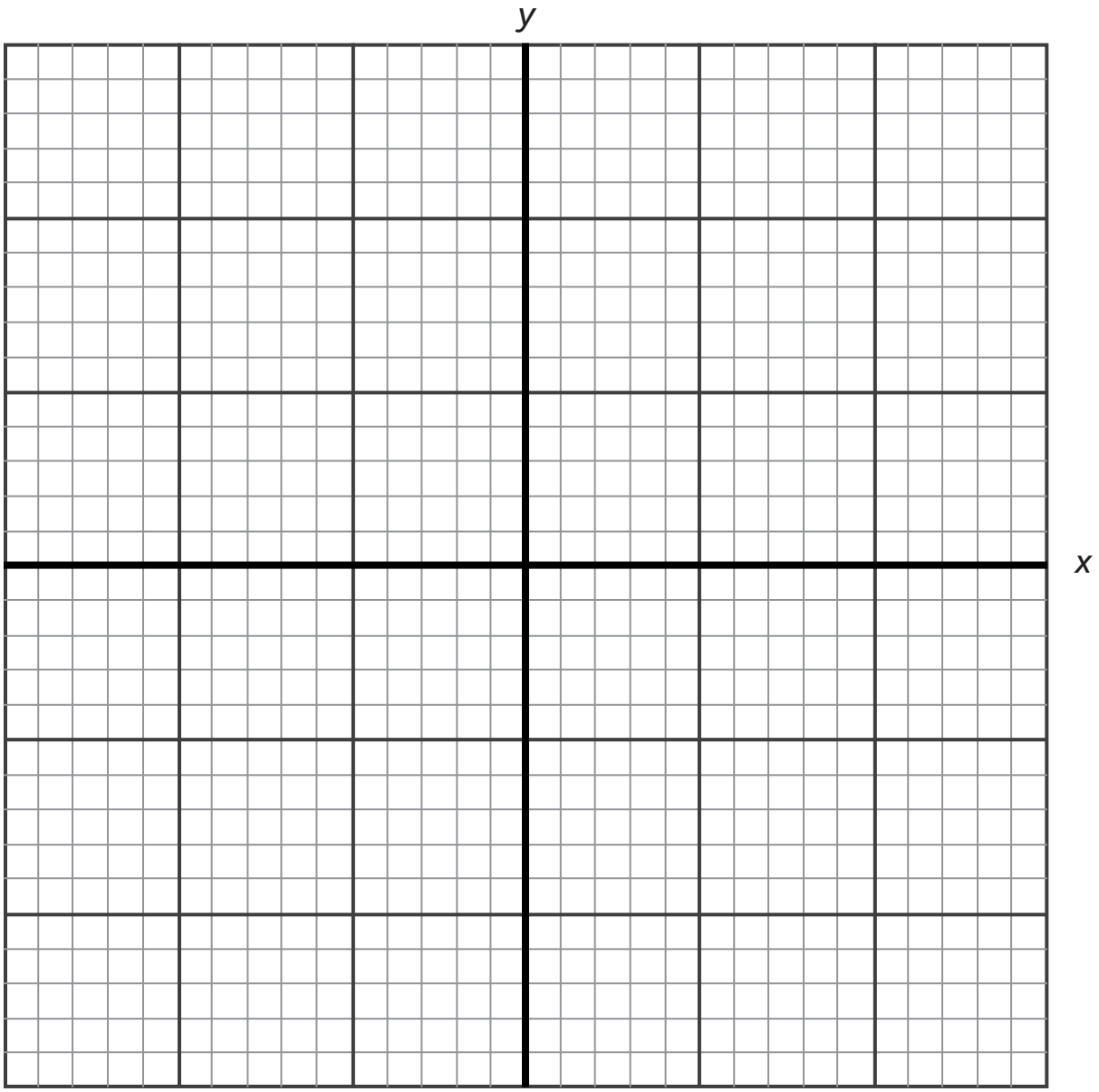
Plotting (x,y) Coordinates

x	y
–13	11
–11	3
–8	8
–2	6
–1	9
–13	–6
–7	–5
–3	–5
–4	–8
–4	–11
5	–5
13	–8
3	11
4	4
9	8

x	y
–11	9
–9	6
–6	11
–2	8
1	3
10	3
10	12
–12	–7
–9	–10
1	–6
5	–10
6	–12
8	–6
12	–3
13	–10

x	y
–12	10
–10	4
–7	10
8	11
11	4
11	7
–13	–7
–7	–7
–8	–11
0	–4
2	–8
5	–7
7	–9
9	–8
13	–5

x	y
–9	7
–1	4
–1	11
1	7
1	11
5	12
7	10
9	3
–8	–12
–9	–9
–1	12
1	11
5	12
10	10
12	12



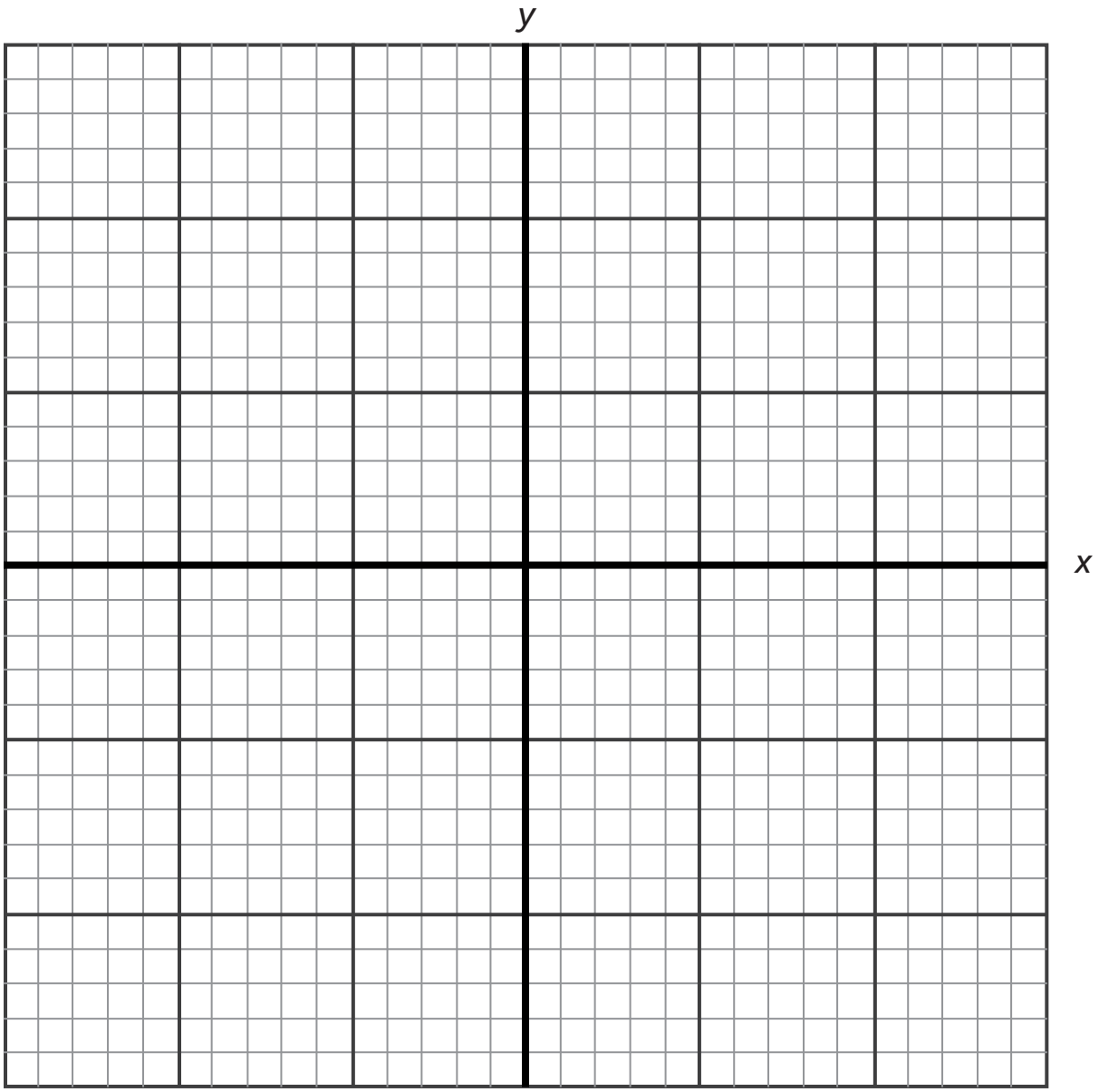
Plotting (x,y) Coordinates

x	y
–13	10
–11	7
–8	10
–6	5
–4	3
–3	11
8	10
10	7
7	–5
7	–7
10	–12
3	–12
10	–8
–6	–9
–2	–8

x	y
–13	4
–10	11
–9	7
–7	4
–4	7
–1	7
2	11
2	3
9	5
9	10
–9	–7
–7	–5
–1	–7
7	–10
11	–11

x	y
–12	10
–10	4
–7	10
8	11
11	4
11	7
–13	–7
–7	–7
–8	–11
0	–4
2	–8
5	–7
7	–9
9	–8
13	–5

x	y
–13	6
–9	3
–7	9
–3	6
–2	4
6	11
9	8
10	11
–12	–12
–9	–9
–5	–11
–2	–5
–1	–12
–6	–4
–6	–9



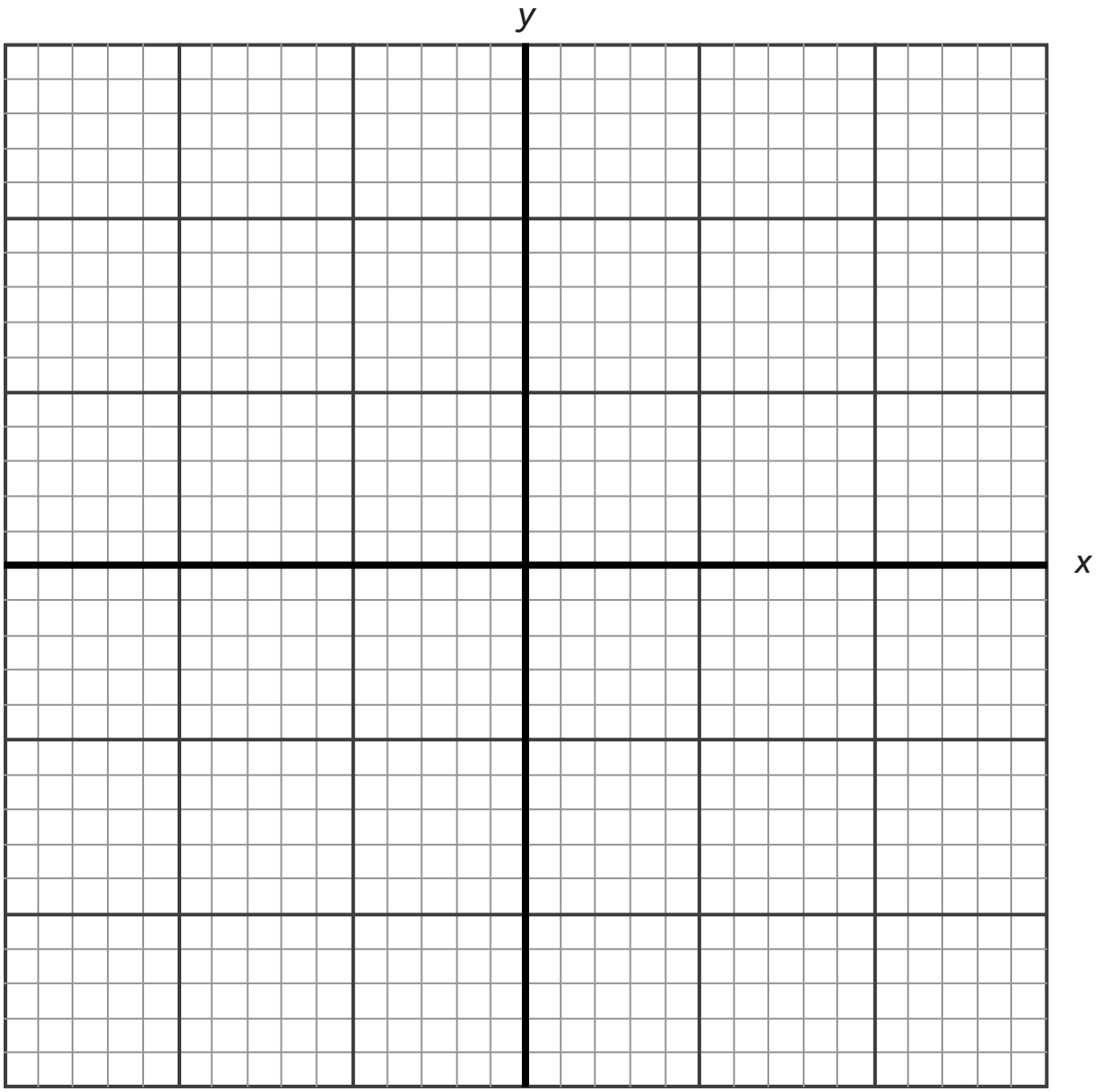
Plotting (x,y) Coordinates

x	y
–13	10
–11	7
–8	10
–6	5
–4	3
–3	11
8	10
10	7
7	–5
7	–7
10	–12
3	–12
10	–8
–6	–9
–2	–8

x	y
–13	4
–10	11
–9	7
–7	4
–4	7
–1	7
2	11
2	3
9	5
9	10
–9	–7
–7	–5
–1	–7
7	–10
11	–11

x	y
–12	10
–10	4
–7	10
8	11
11	4
11	7
–13	–7
–7	–7
–8	–11
0	–4
2	–8
5	–7
7	–9
9	–8
13	–5

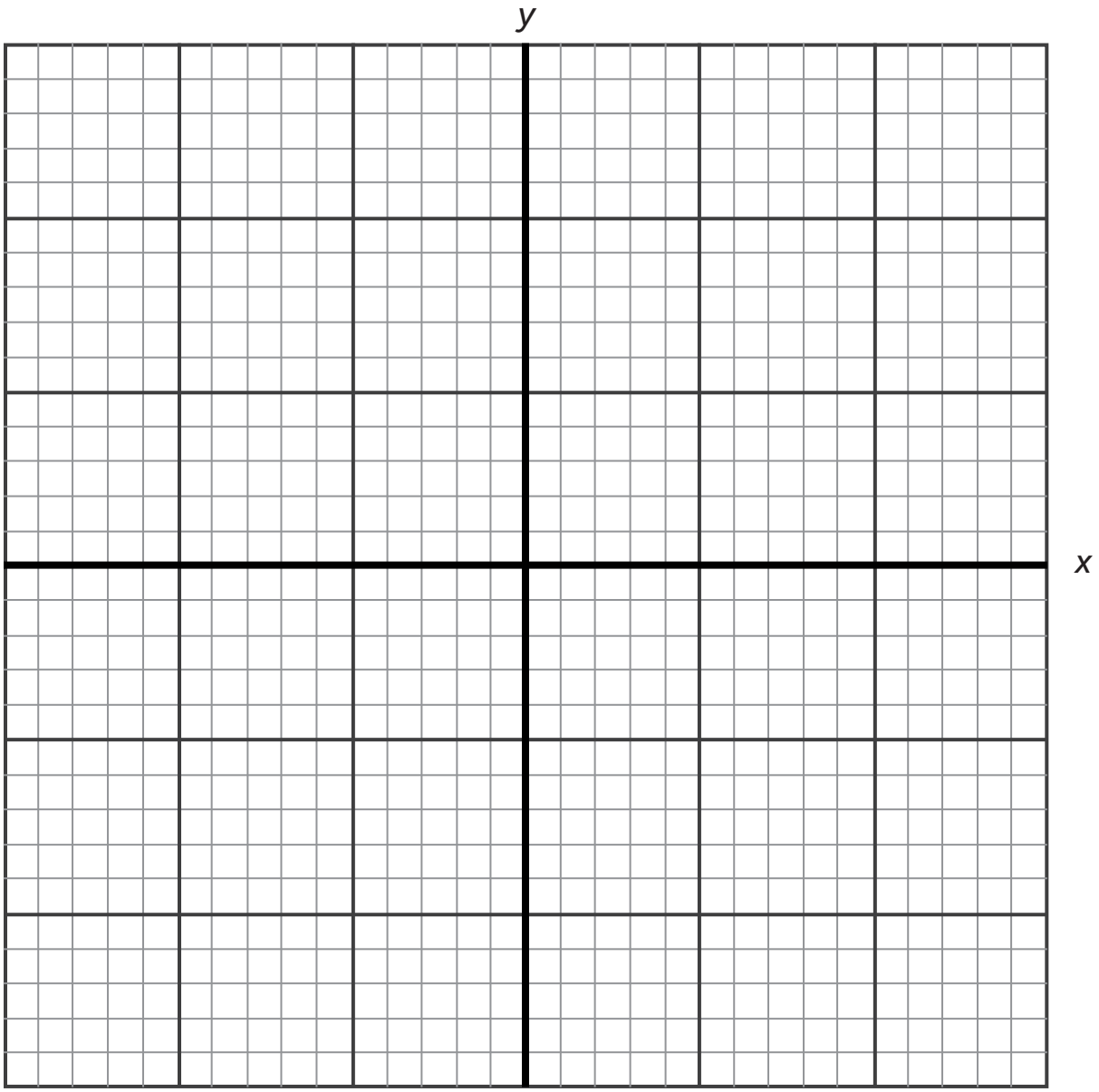
x	y
–13	6
–9	3
–7	9
–3	6
–2	4
6	11
9	8
10	11
–12	–12
–9	–9
–5	–11
–2	–5
–1	–12
–6	–4
–6	–9



Plotting Linear Equations

$y = -3x + 5$

x	y
0	
1	
2	
3	
4	
5	
6	
−1	
−2	
−3	

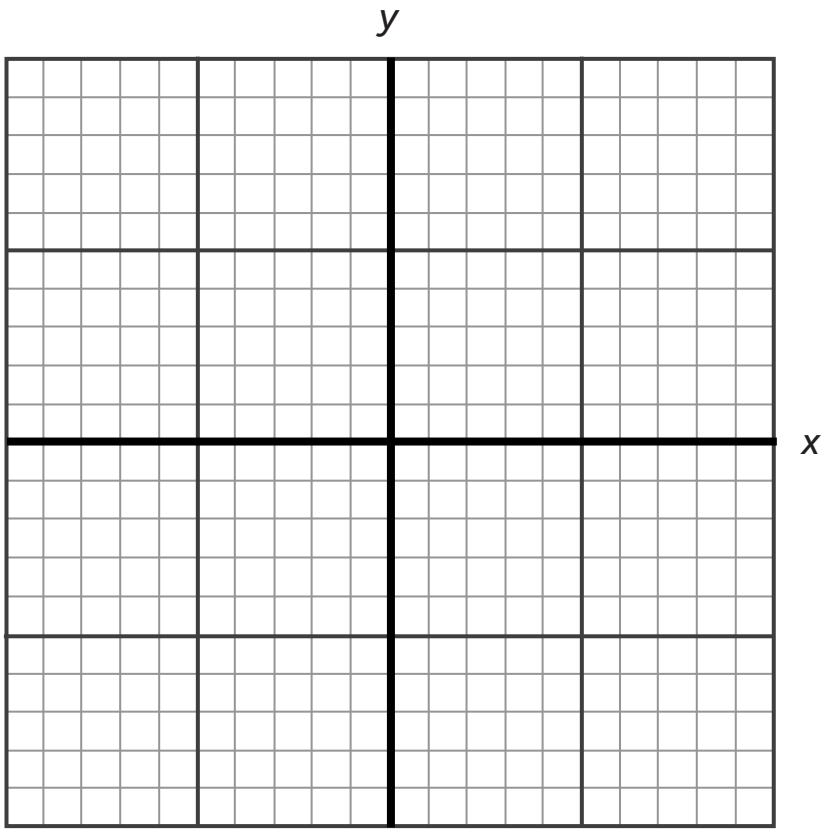


Plotting Linear Equations

$y = x - 3$

x	y
0	
1	
2	
3	

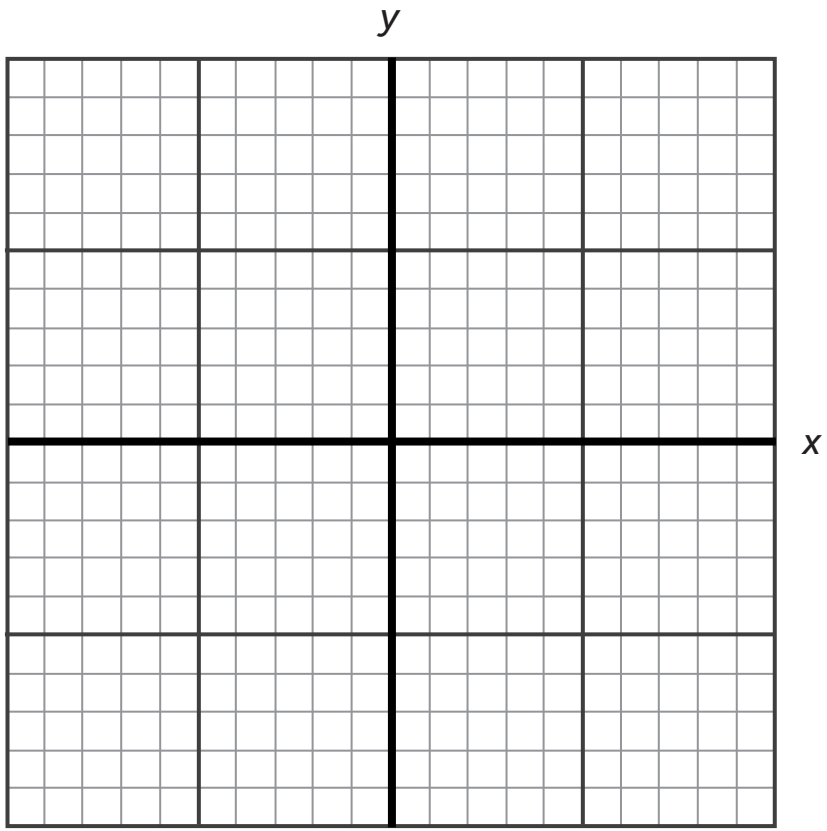
x	y
−1	
−2	
−3	
−4	



$y = -3x - 14$

x	y
−4	
−5	
−6	

x	y
0	
−1	
−2	
−3	



Plotting Linear Equations

$y = -2x - 3$

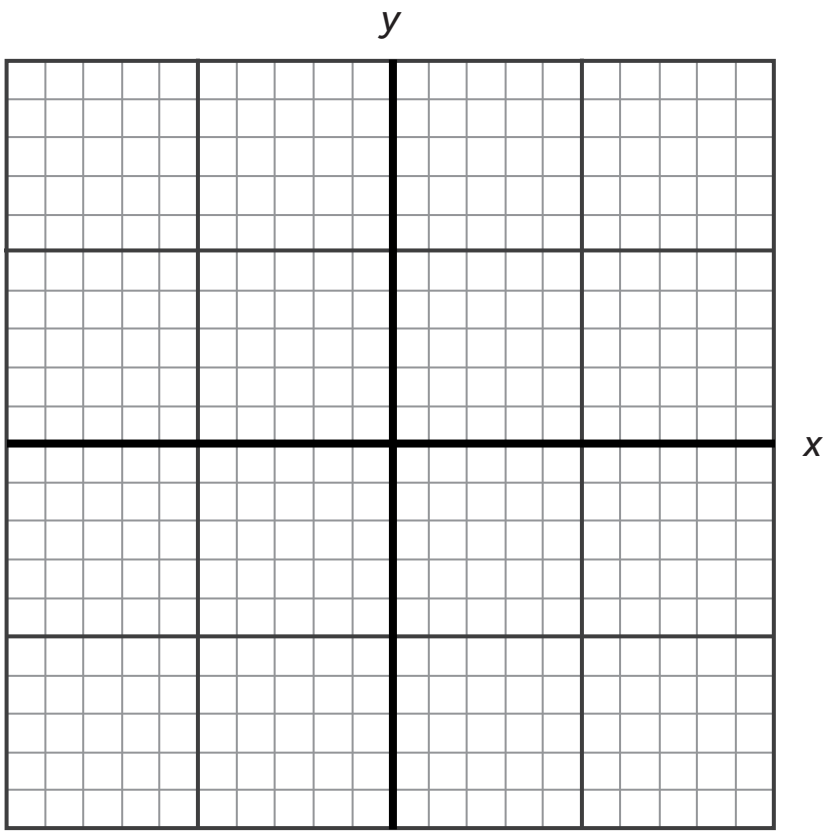
x	y
0	
1	
2	
3	

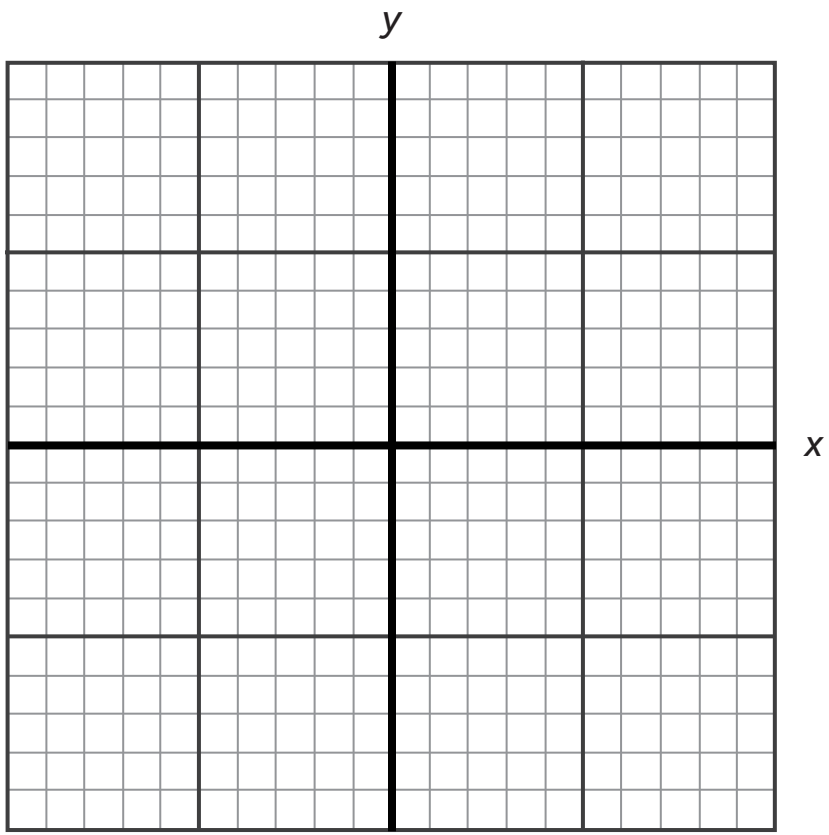
x	y
−1	
−2	
−3	
−4	

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

x	y
−3	
−6	
−9	

x	y
0	
3	
6	
9	
12	



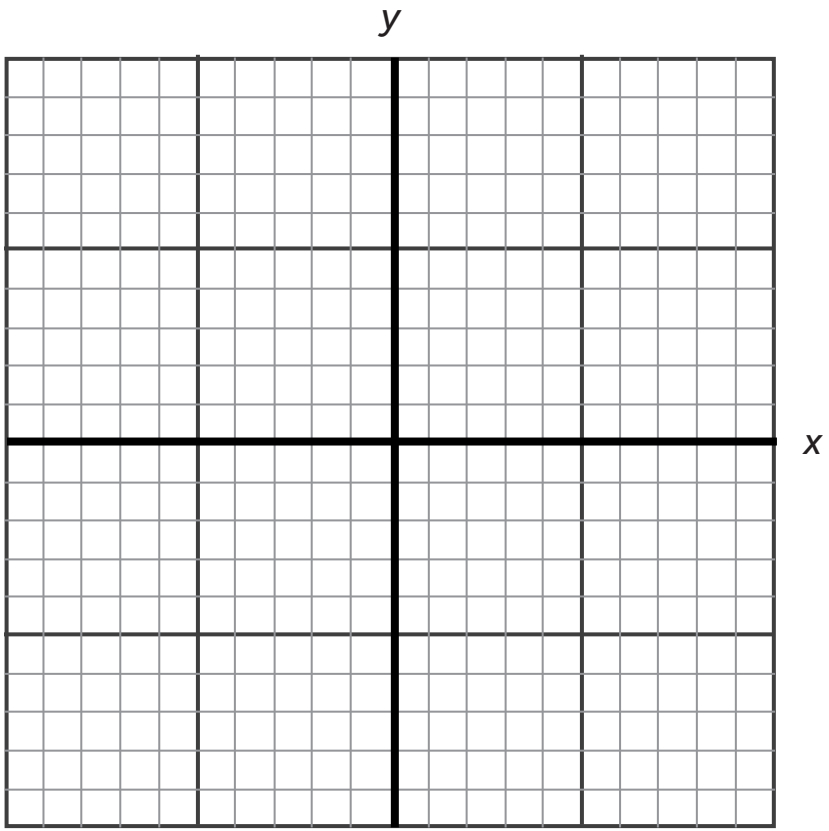


Plotting Linear Equations

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

x	y
−2	
−4	
−6	
−8	

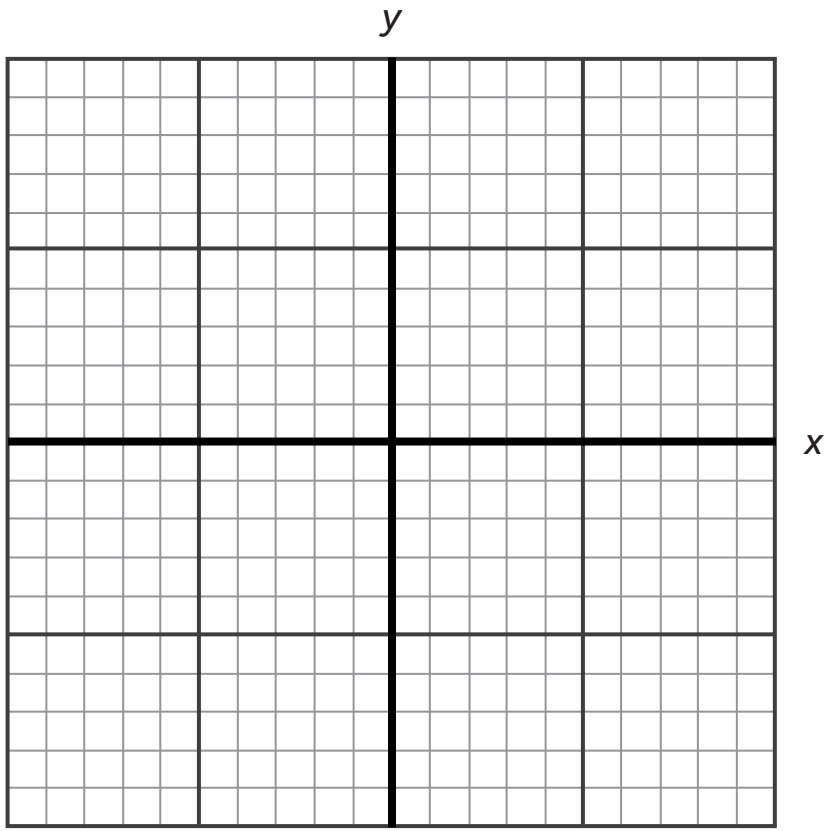
x	y
0	
2	
4	
6	
8	



$y = -x - 3$

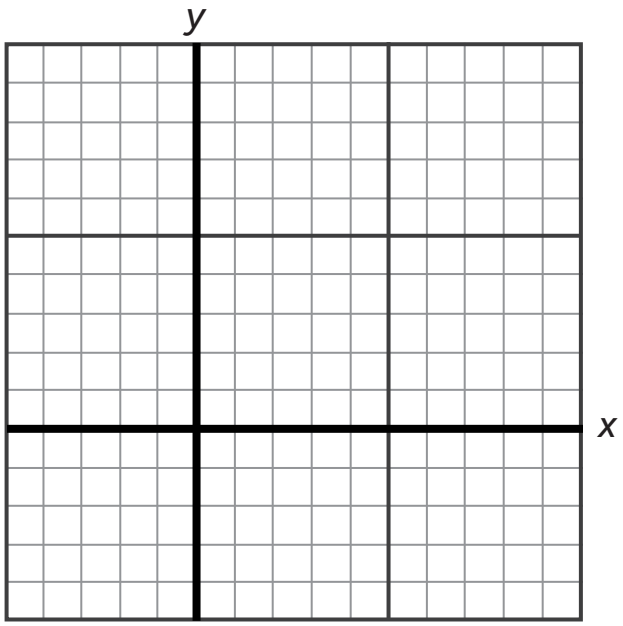
x	y
−1	
−2	
−3	

x	y
0	
1	
2	
3	
4	

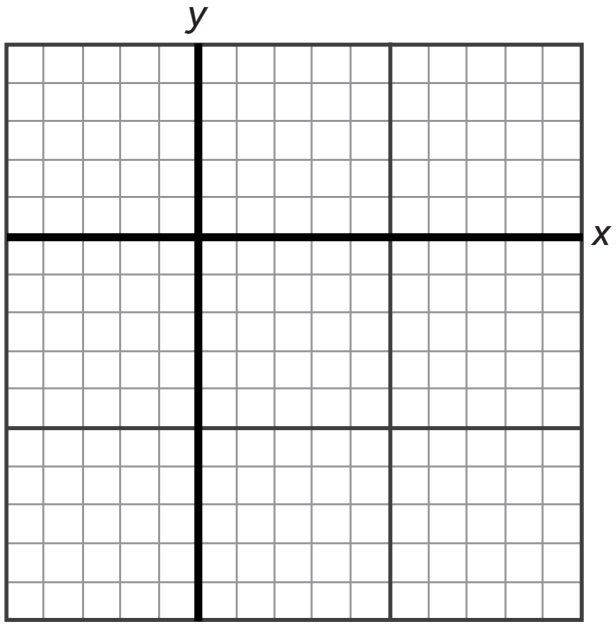


Plotting Linear Equations

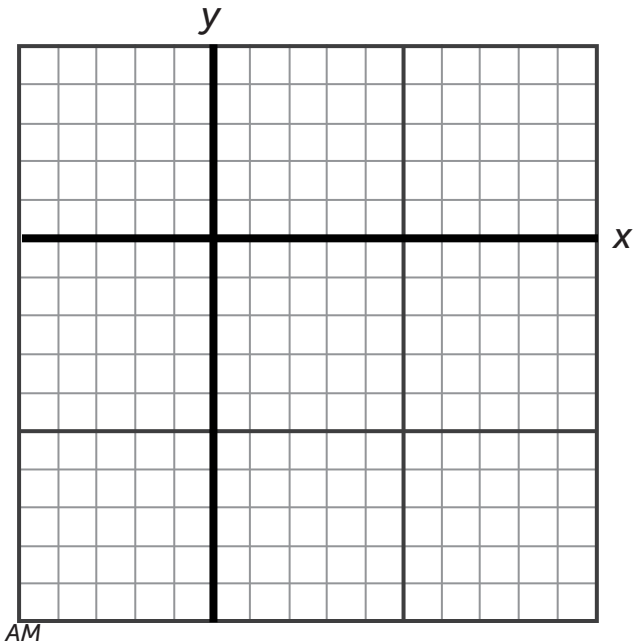
$y = -3x + 9$



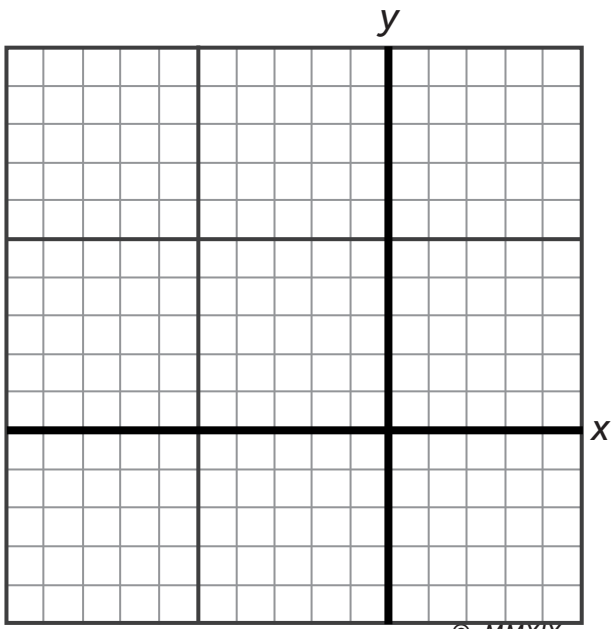
$y = -x - 7$



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

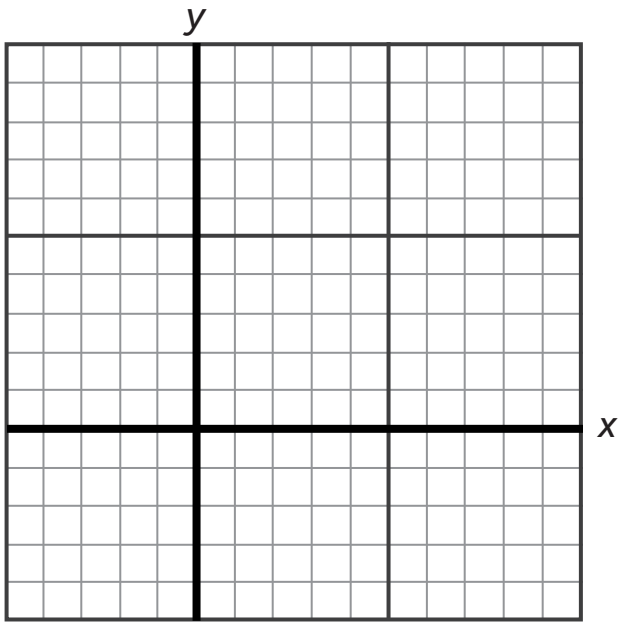


$y = 2x + 6$

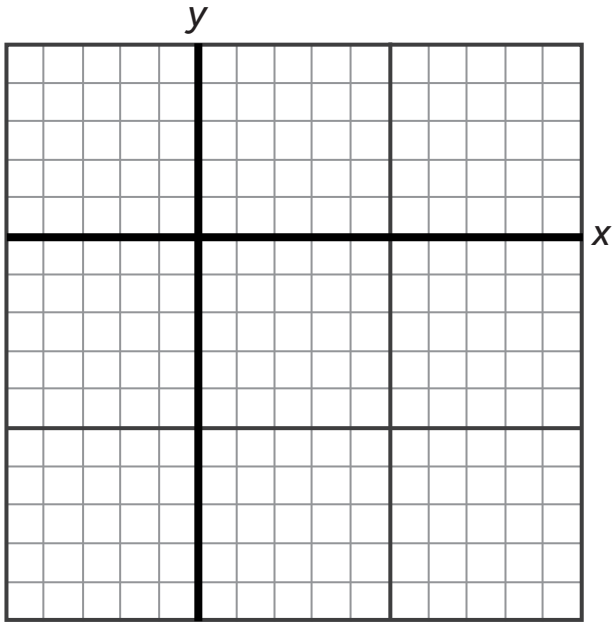


Plotting Linear Equations

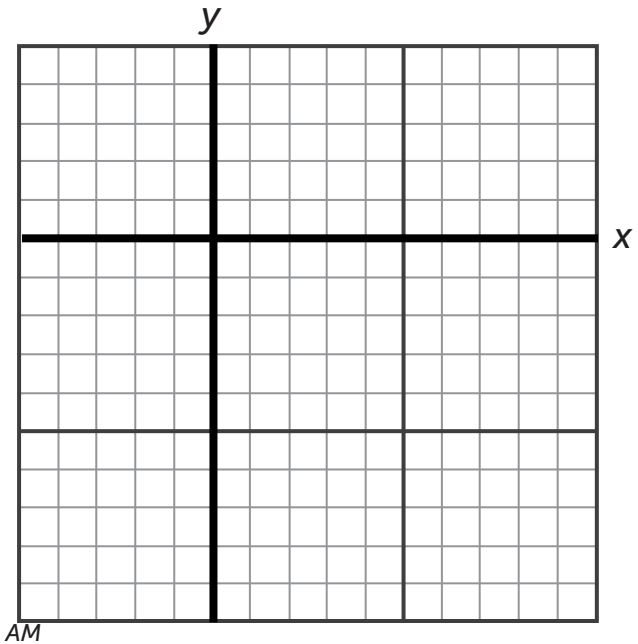
$y = 2x - 3$



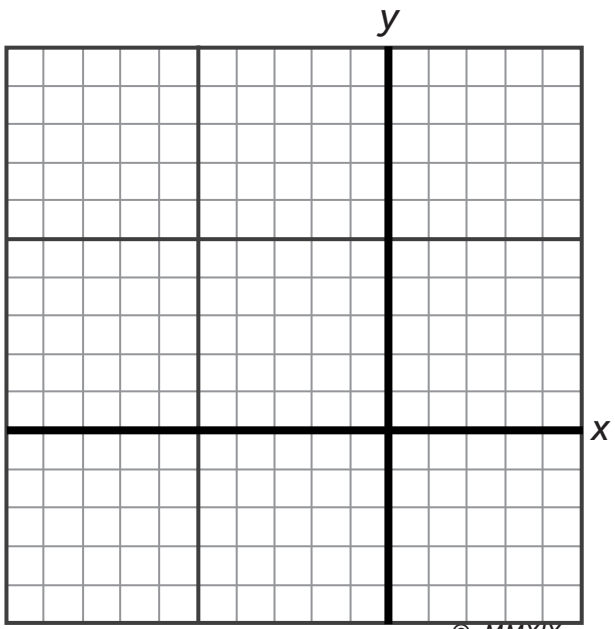
$y = -2x - 2$



$y = -\frac{1}{3}x + 4$

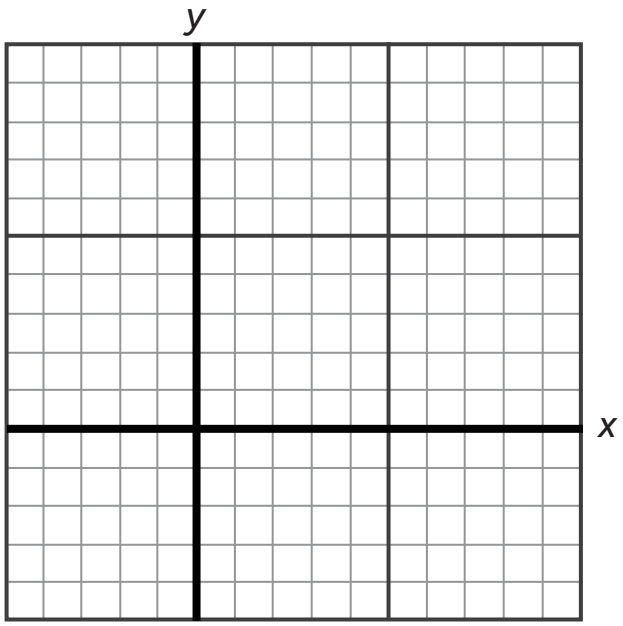


$y = -x - 3$

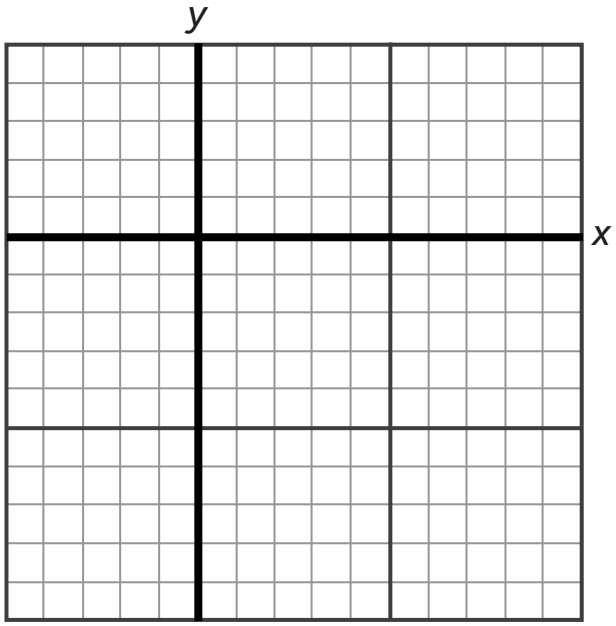


Plotting Linear Equations

$y = x - 3$



$y = -3x + 4$



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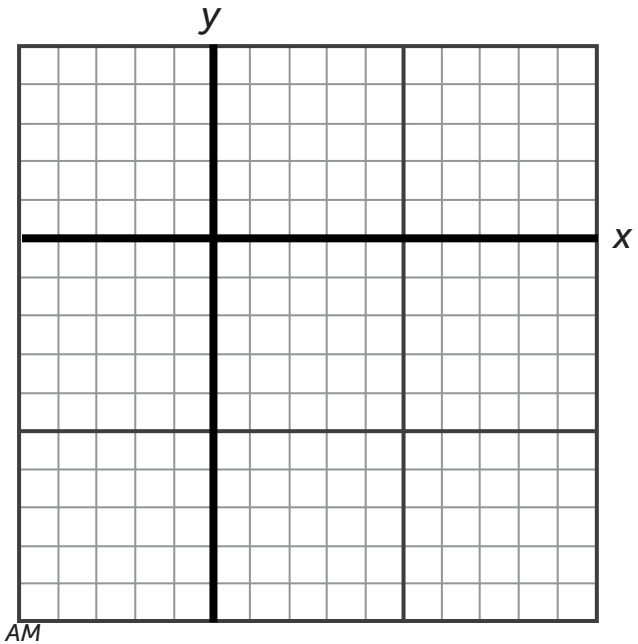
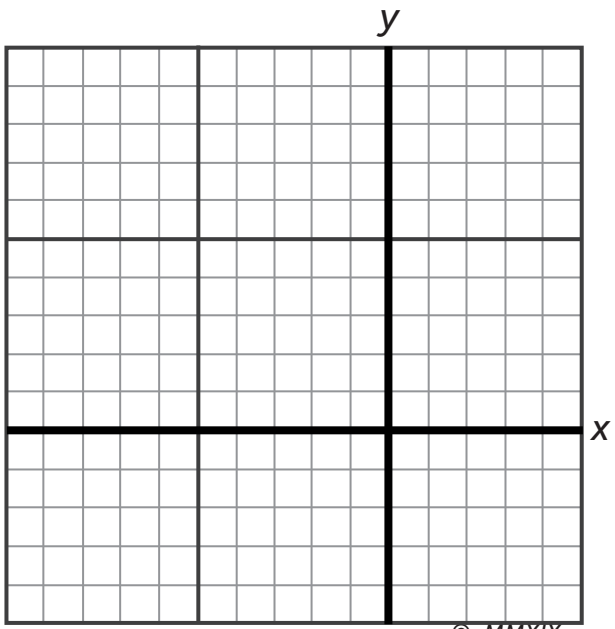
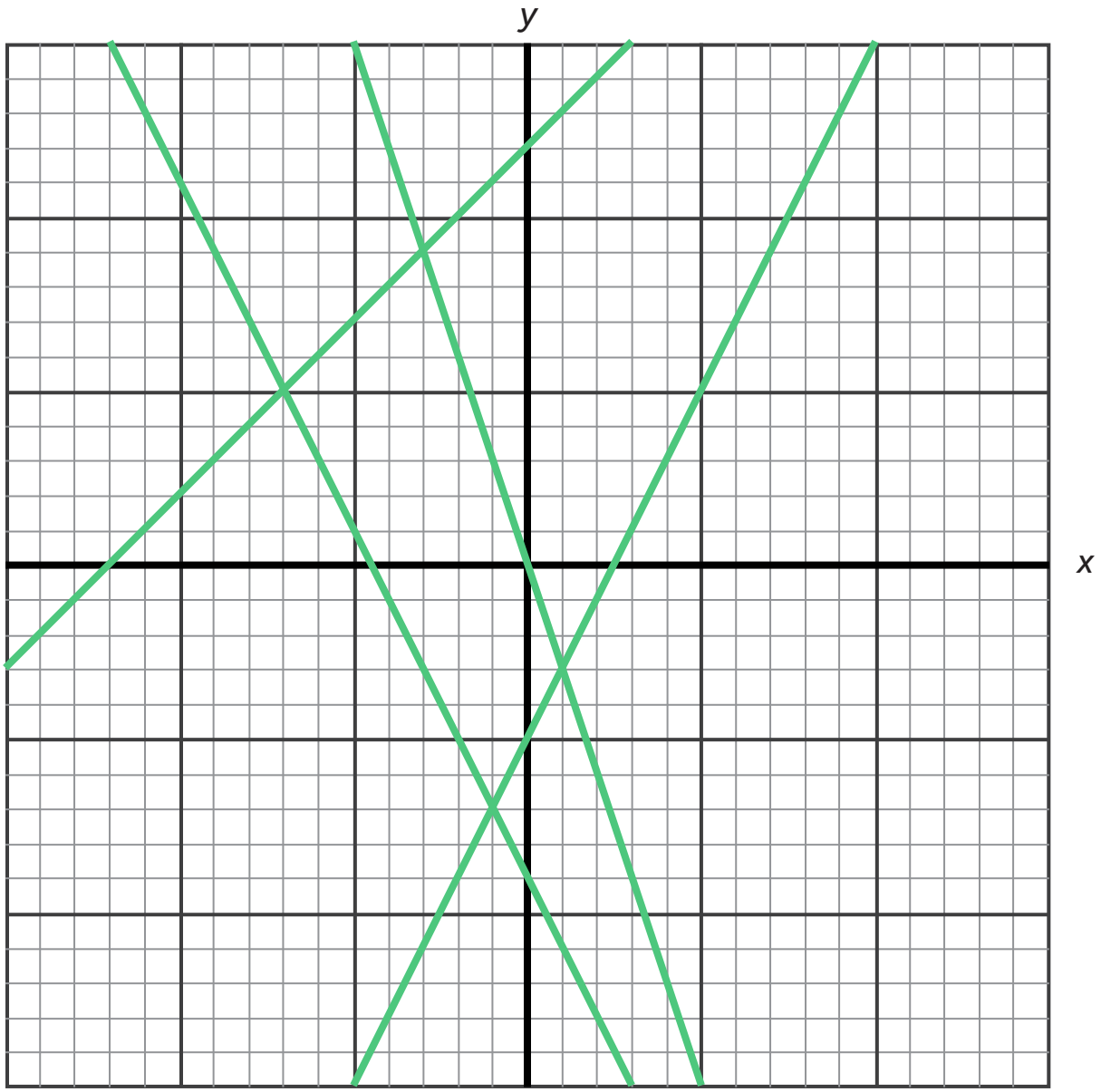


$y = 2x - 2$



Graphing Linear Equations

1. $y = x + 12$
2. $y = 2x - 5$
3. $y = -3x$
4. $y = -2x - 9$



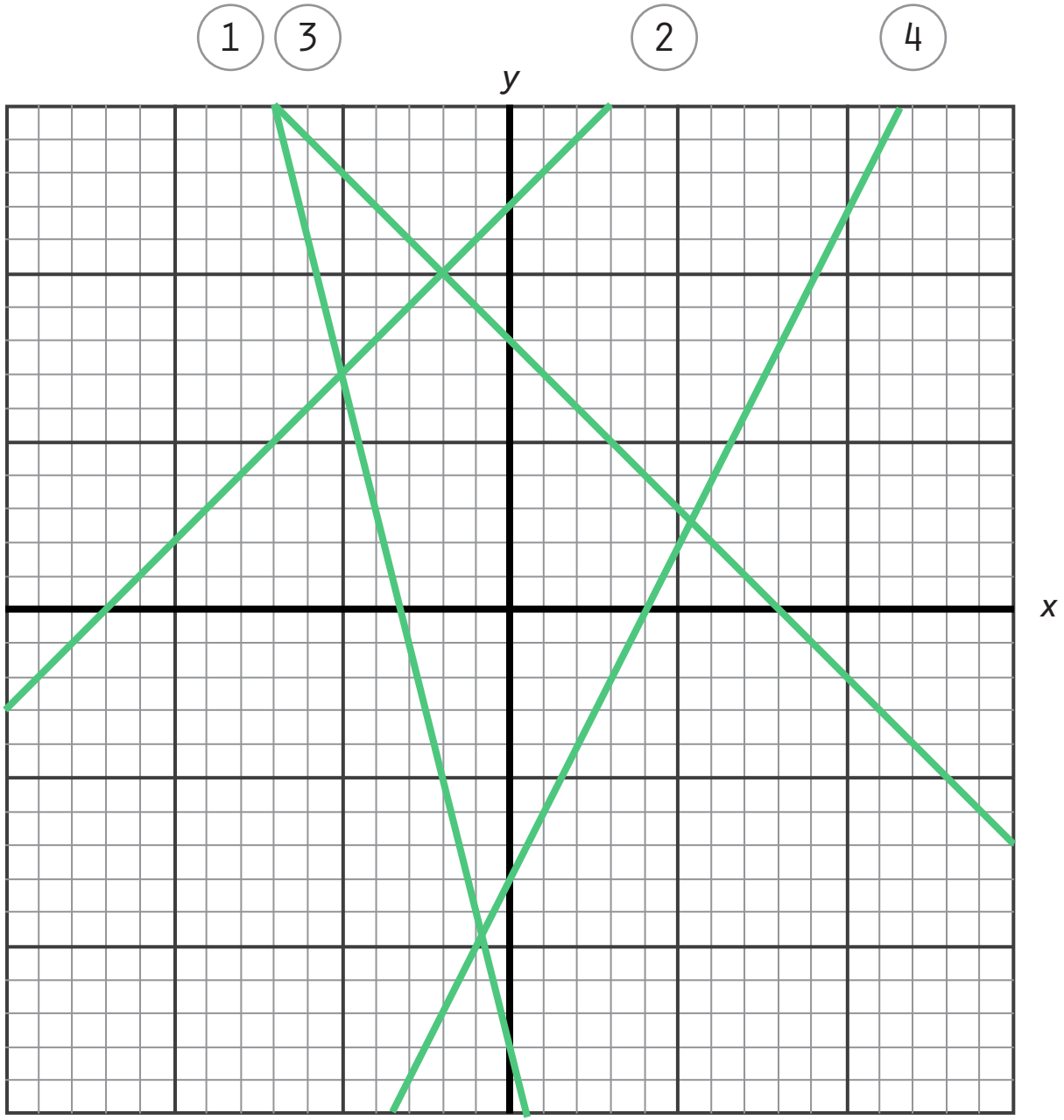
Graphing Linear Equations

$y = -x + 8$

$y = x + 12$

$y = -4x - 13$

$y = 2x - 7$



Graphing Linear Equations

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$y = -3x + 5$

$y = -3x - 4$

$y = -2x + 4$

$y = -x + 6$

$y = -x - 13$

$y = -\frac{1}{4}x - 10$

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

$y = -\frac{1}{2}x - 5$

$y = \frac{1}{2}x + 7$

$y = x - 4$

$y = 2x + 1$

$y = 2x + 6$

$y = 3x - 4$

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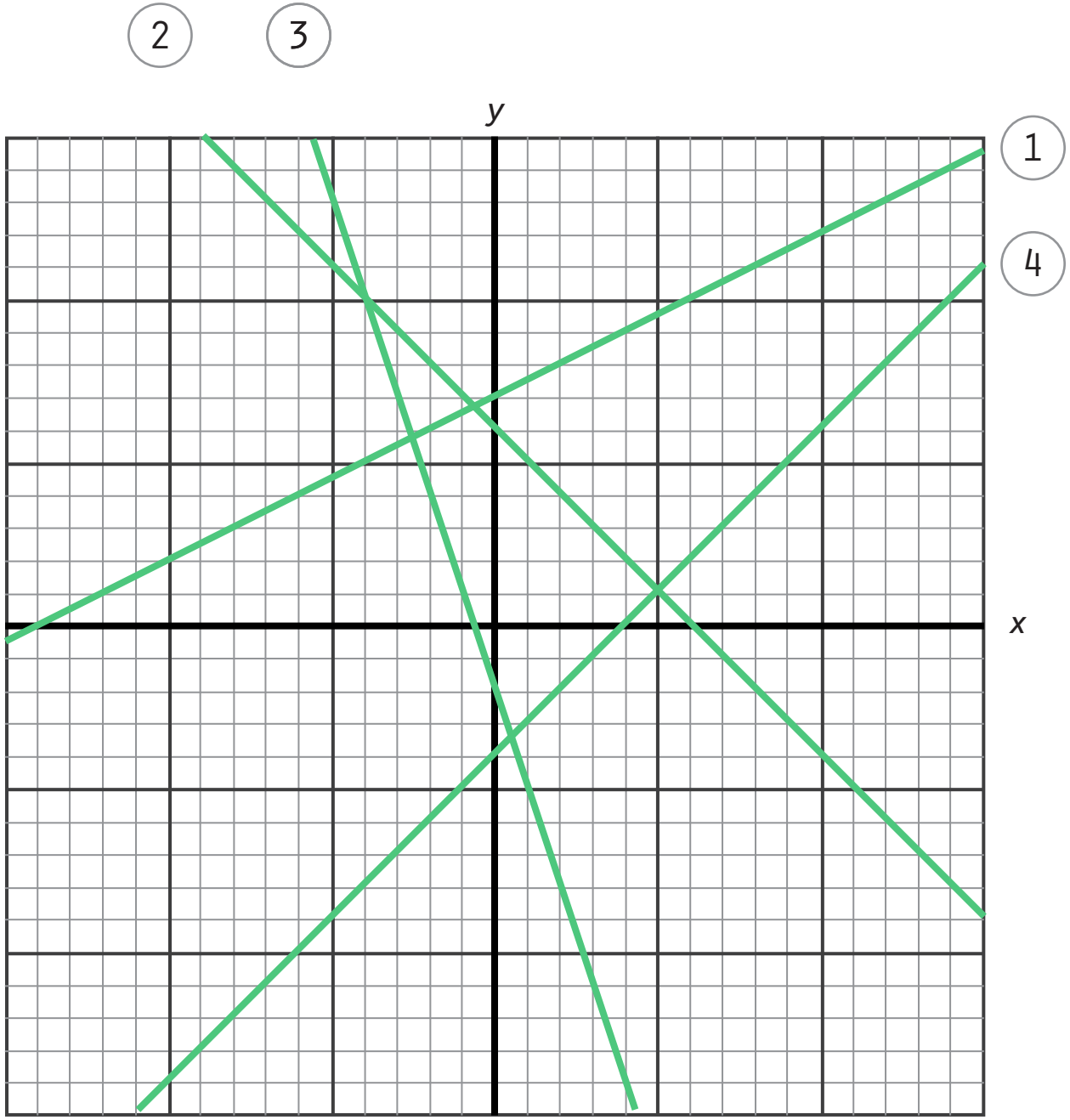

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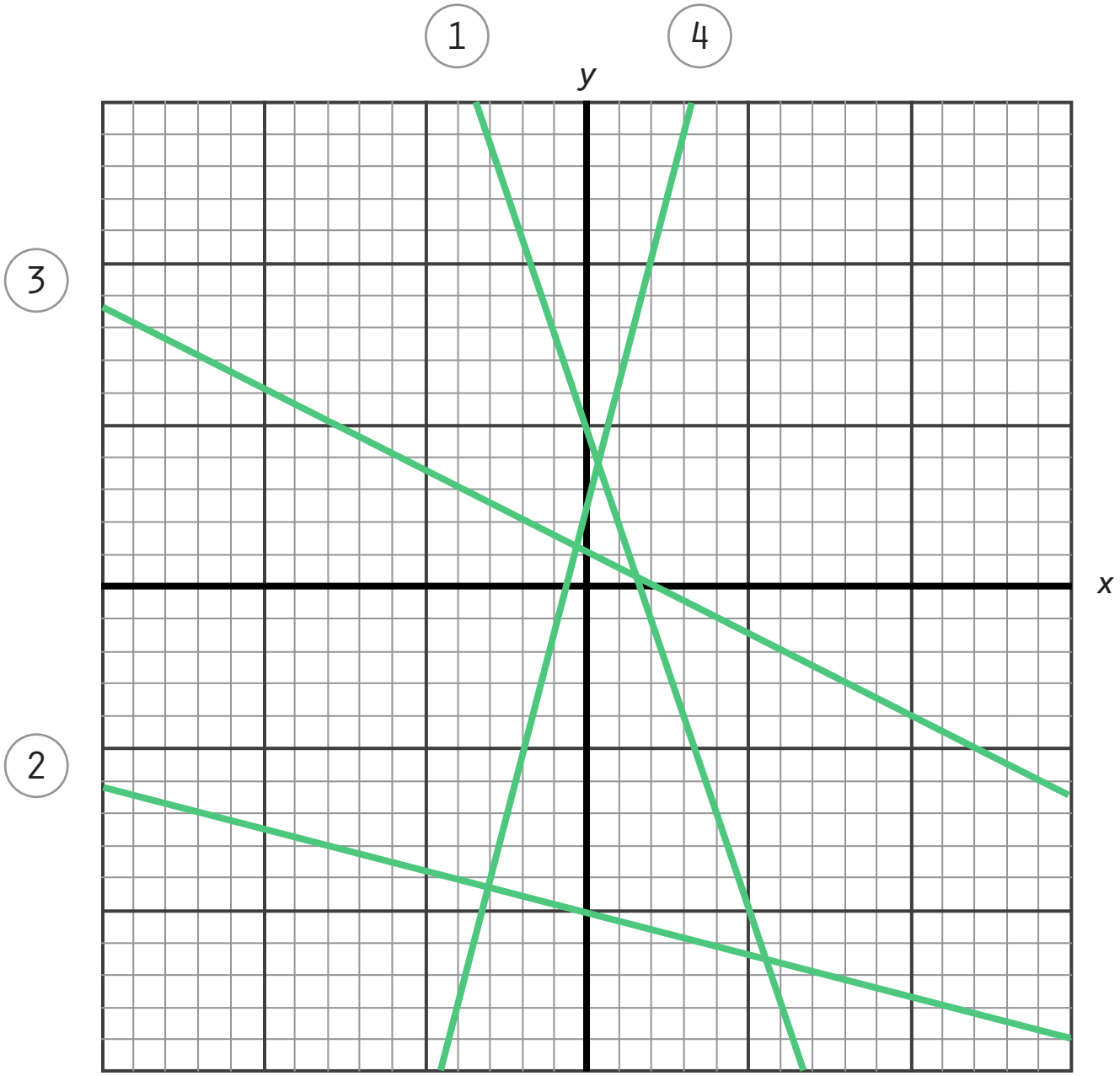

Graphing Linear Equations

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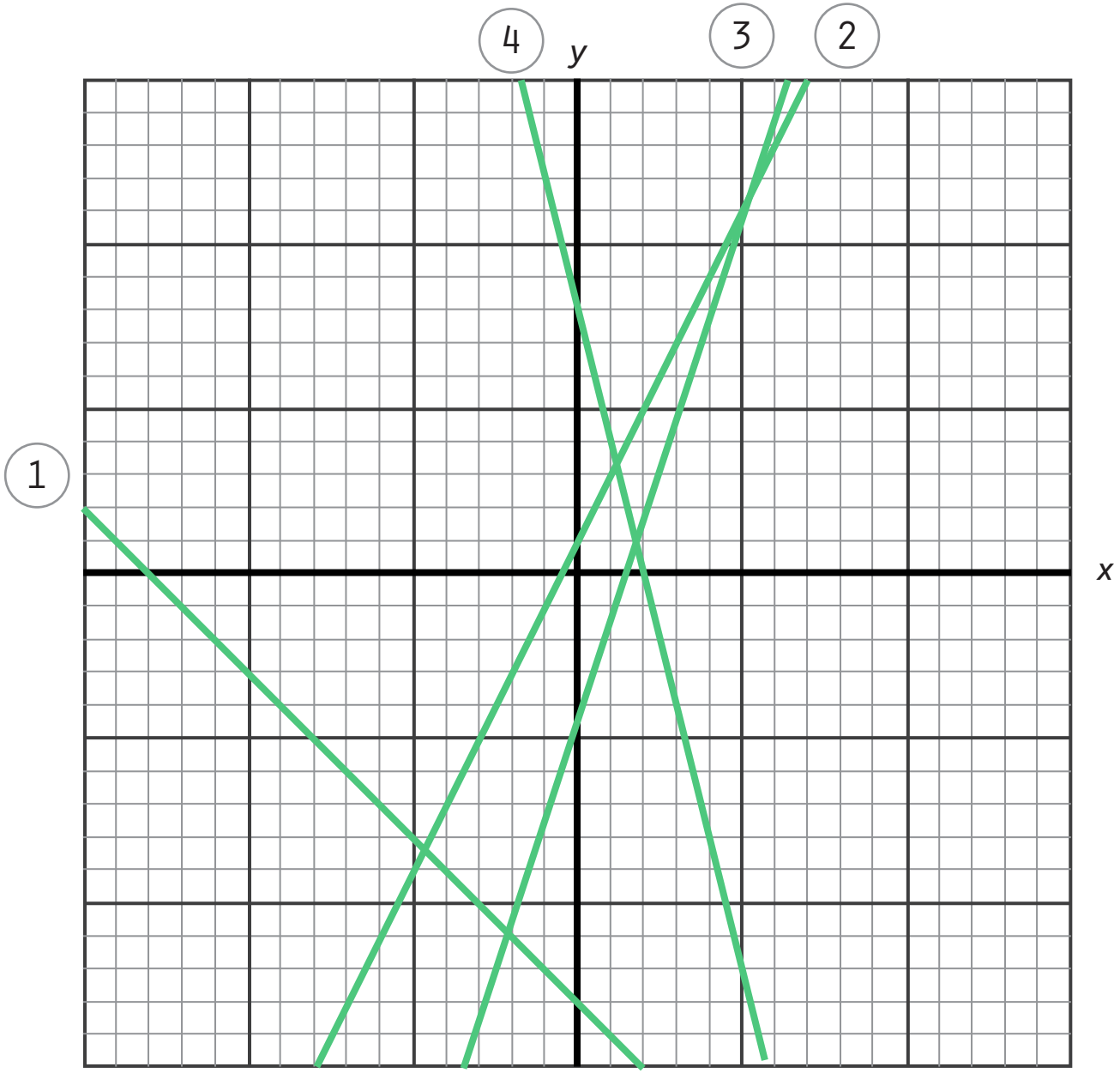

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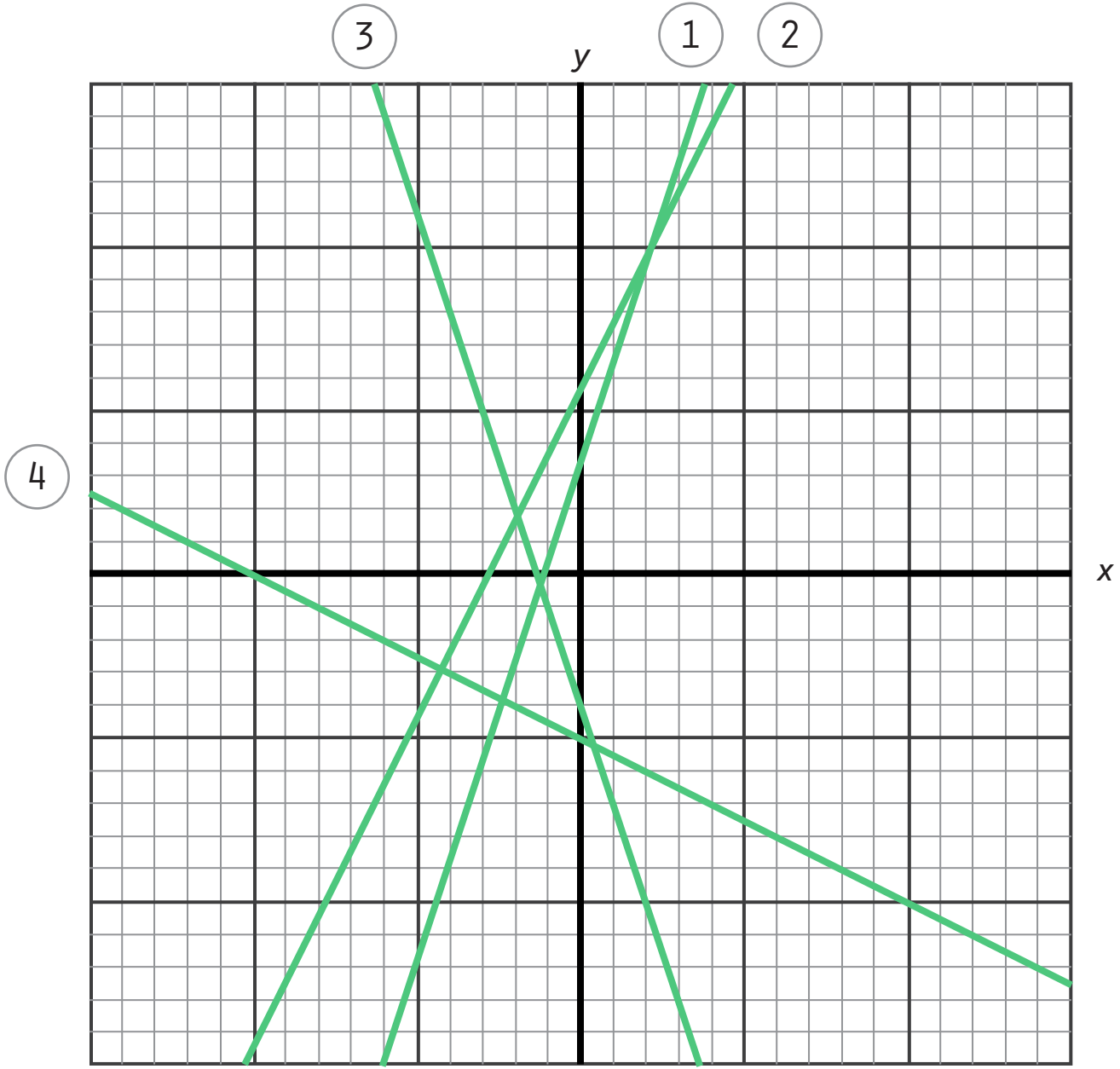

Graphing Linear Equations

$y = -5x + 2$

$y = -4x - 4$

$y = -3x + 8$

$y = -2x - 12$

$y = -x + 13$

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

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

$y = -\frac{1}{4}x - 8$

$y = \frac{1}{4}x + 10$

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$y = x - 2$

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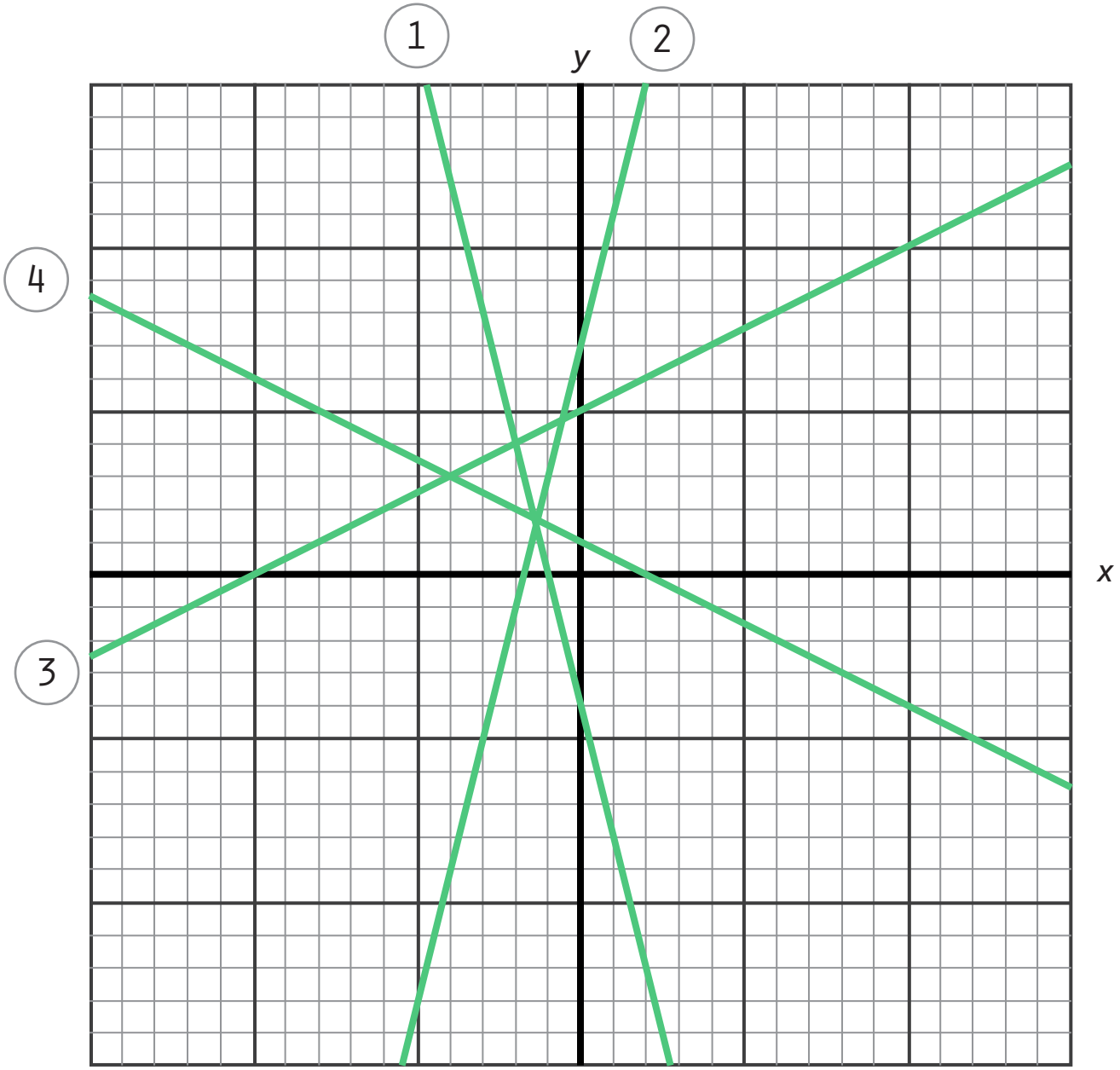
$y = 3x - 4$

$y = 4x + 7$

$y = 5x - 8$



Graphing Linear Equations

$y = -5x + 2$

$y = -4x - 4$

$y = -3x + 8$

$y = -2x - 13$

$y = -x + 13$

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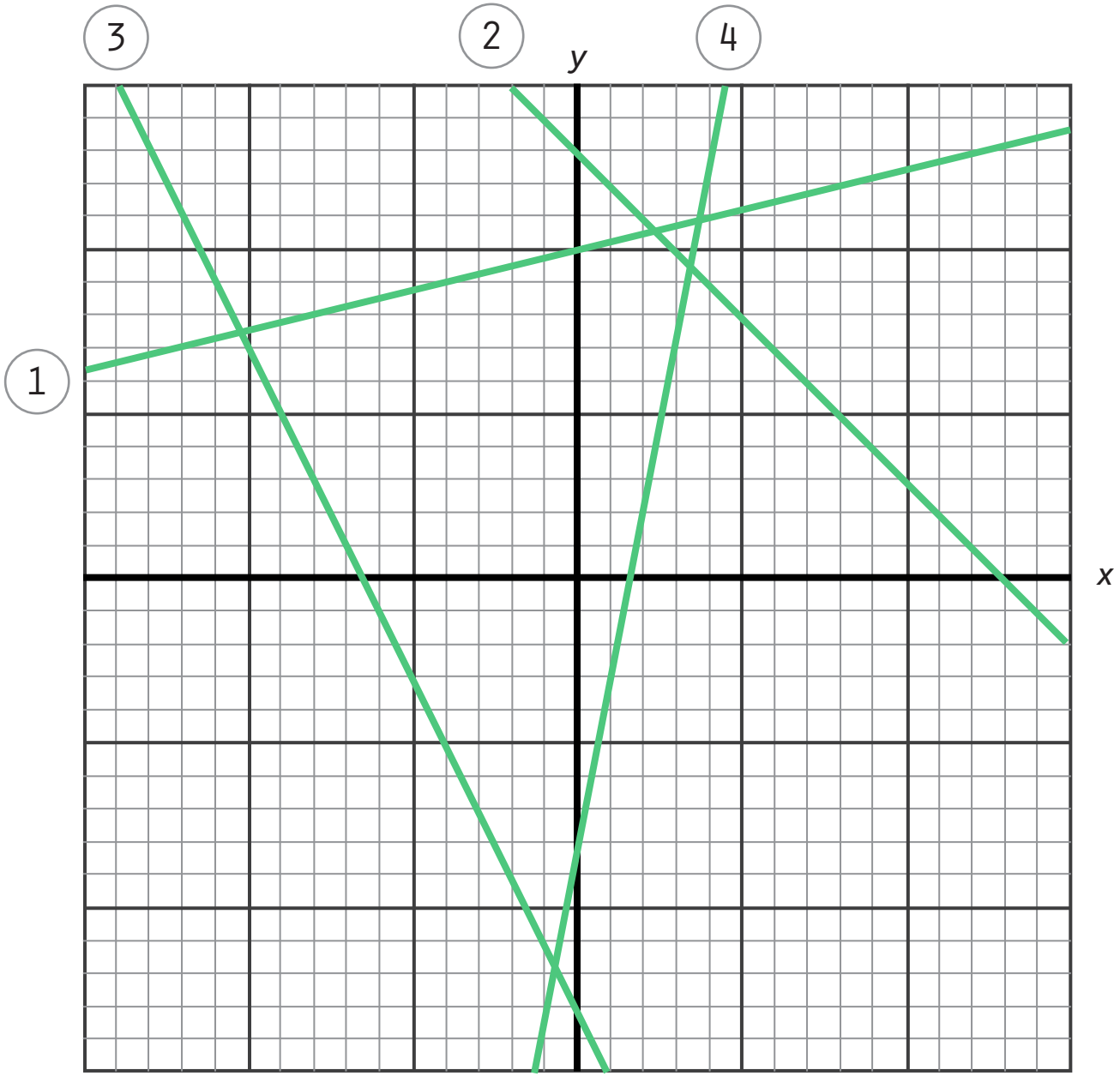

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$y = -4x - 4$

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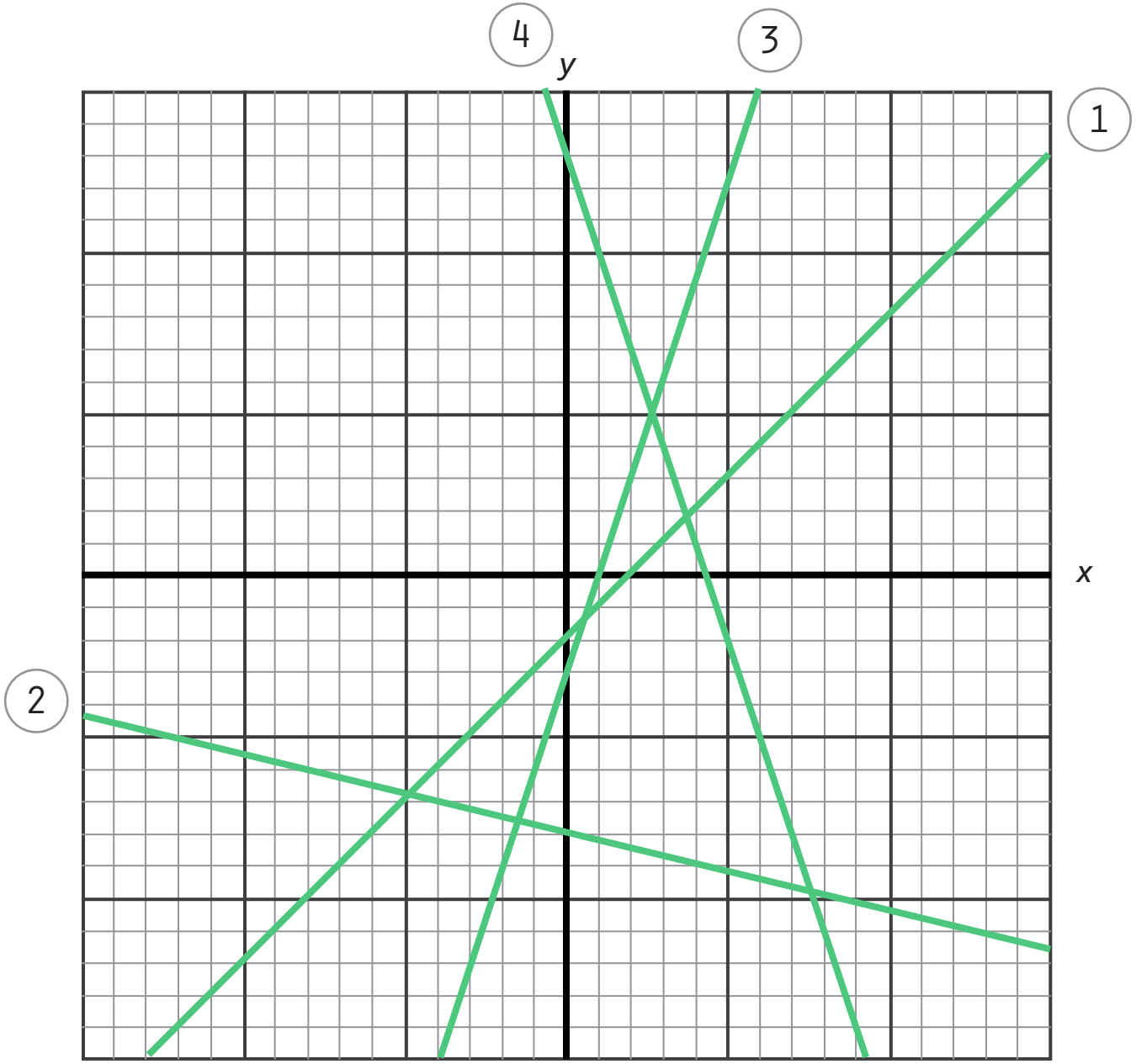

Graphing Linear Equations

$y = -5x + 8$

$y = -3x - 6$

$y = -3x + 2$

$y = -2x - 12$

$y = -2x + 9$

$y = -x + 10$

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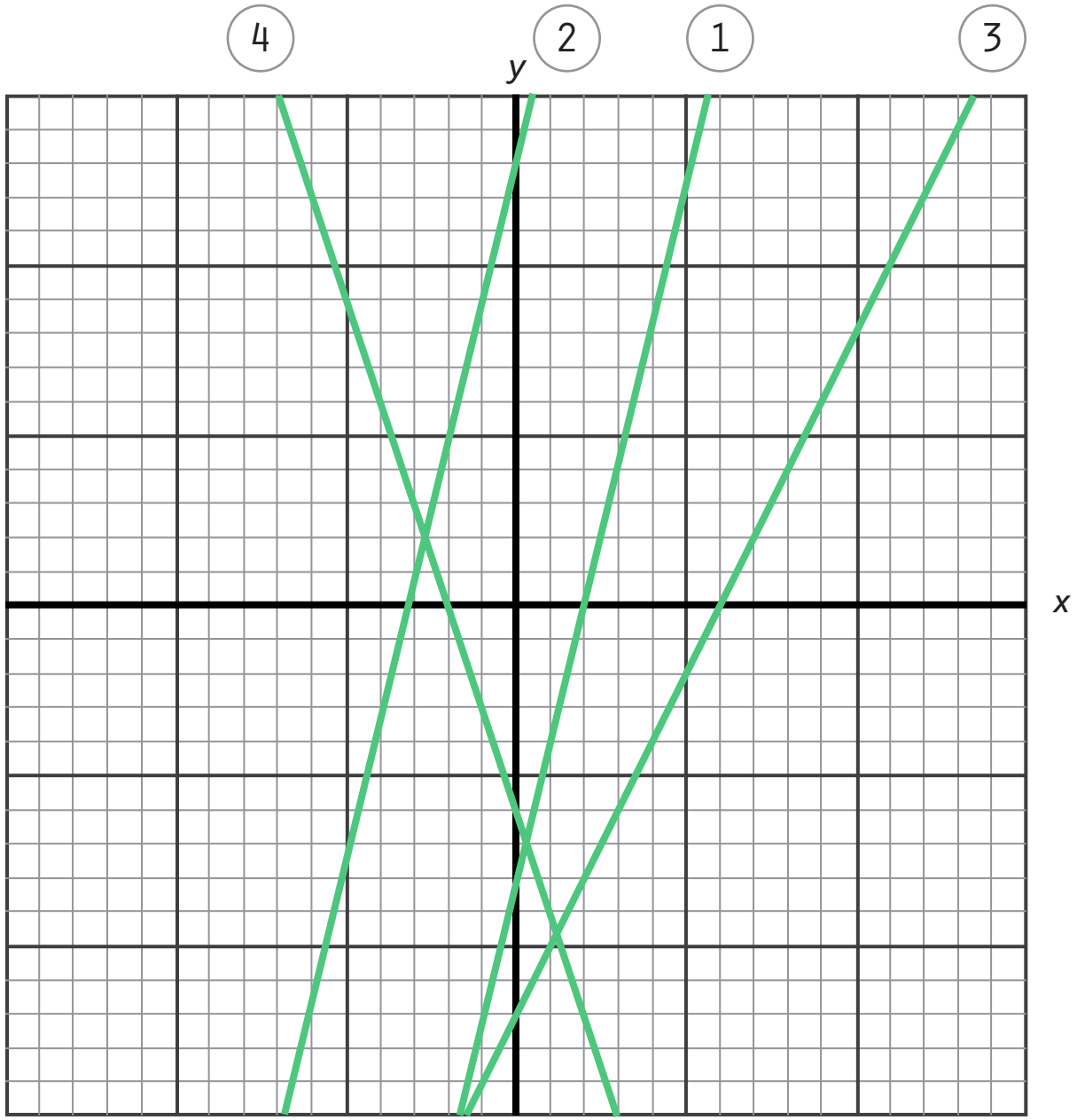

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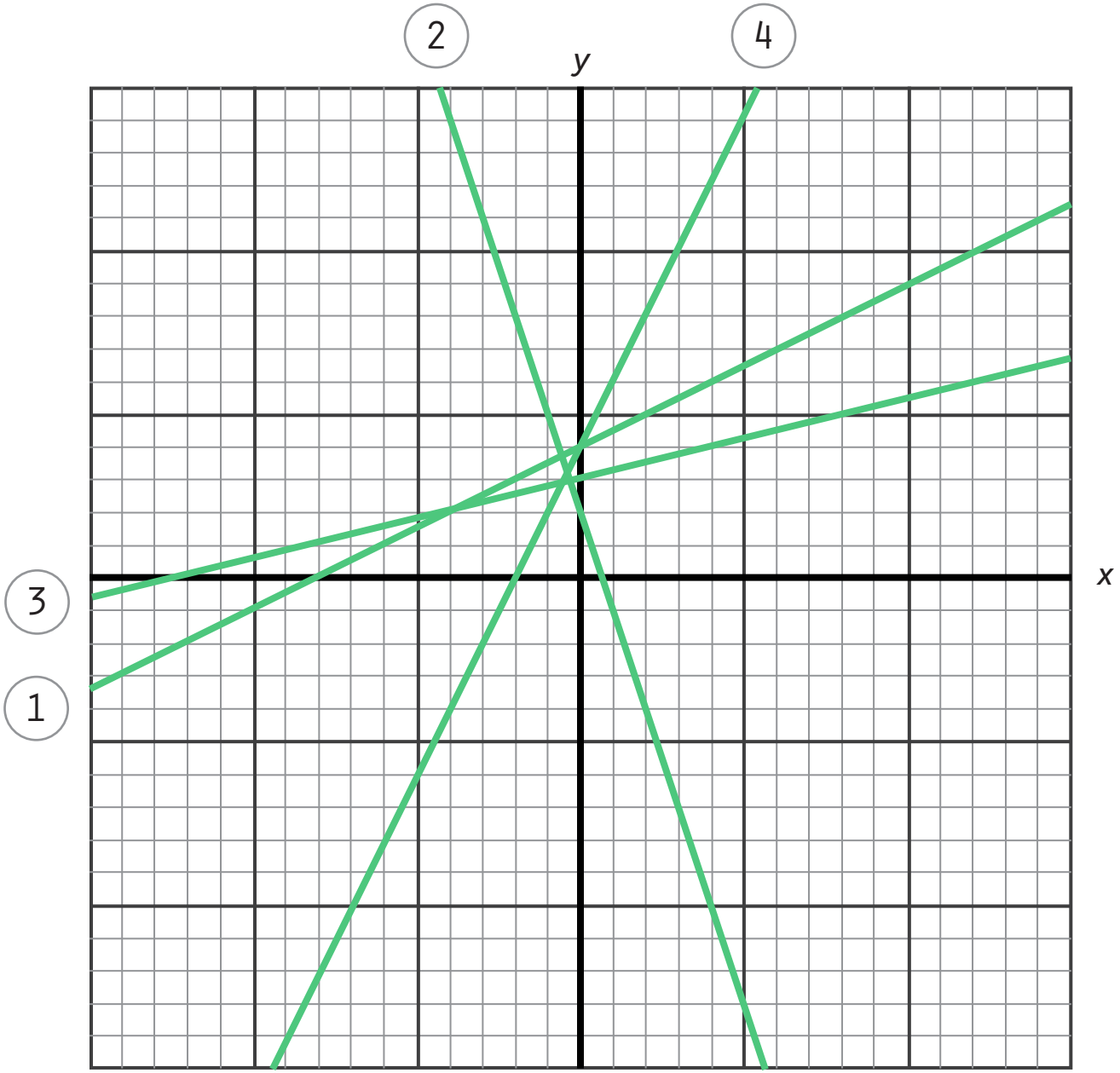

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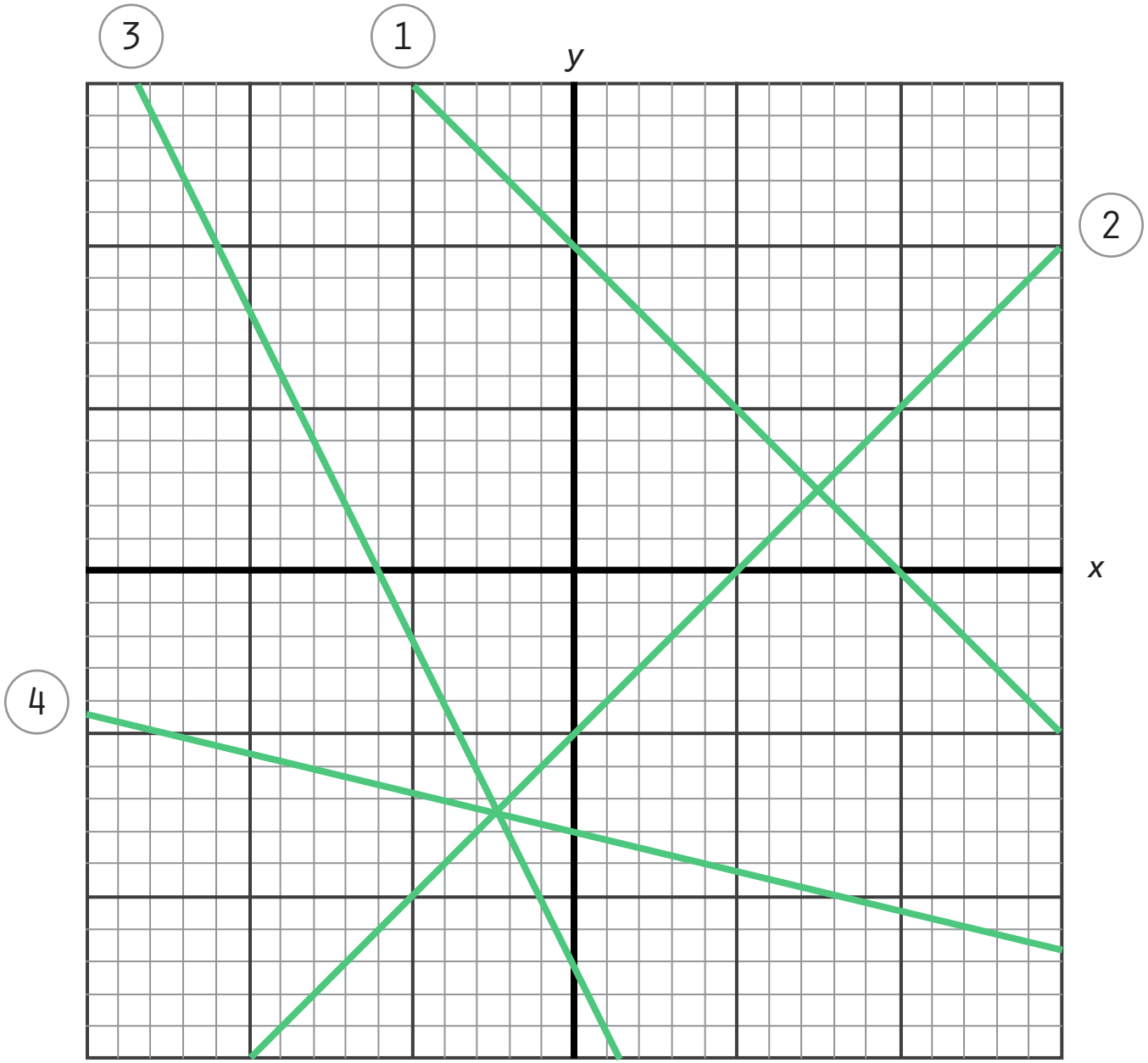

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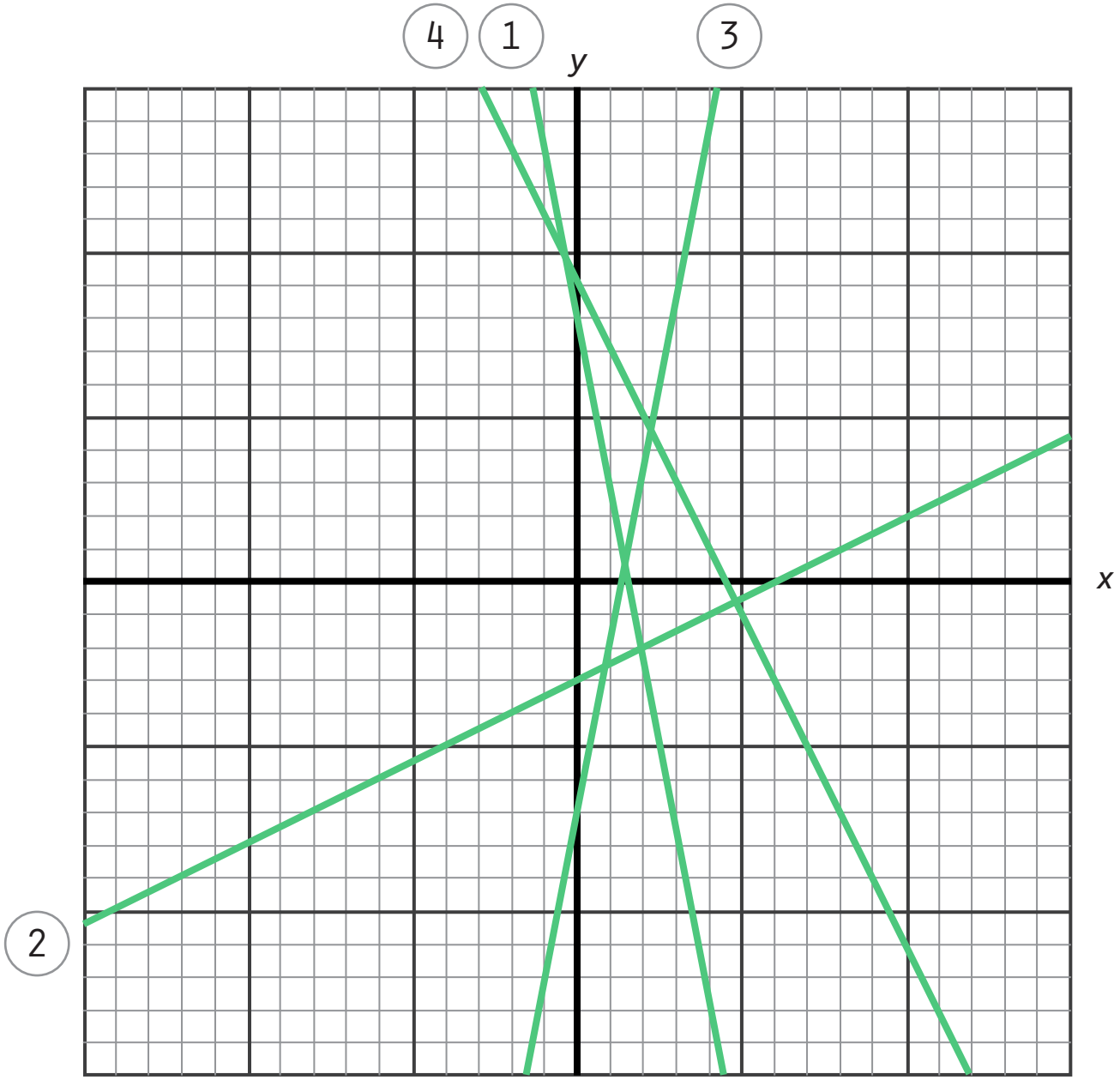

Graphing Linear Equations

$y = -4x - 9$

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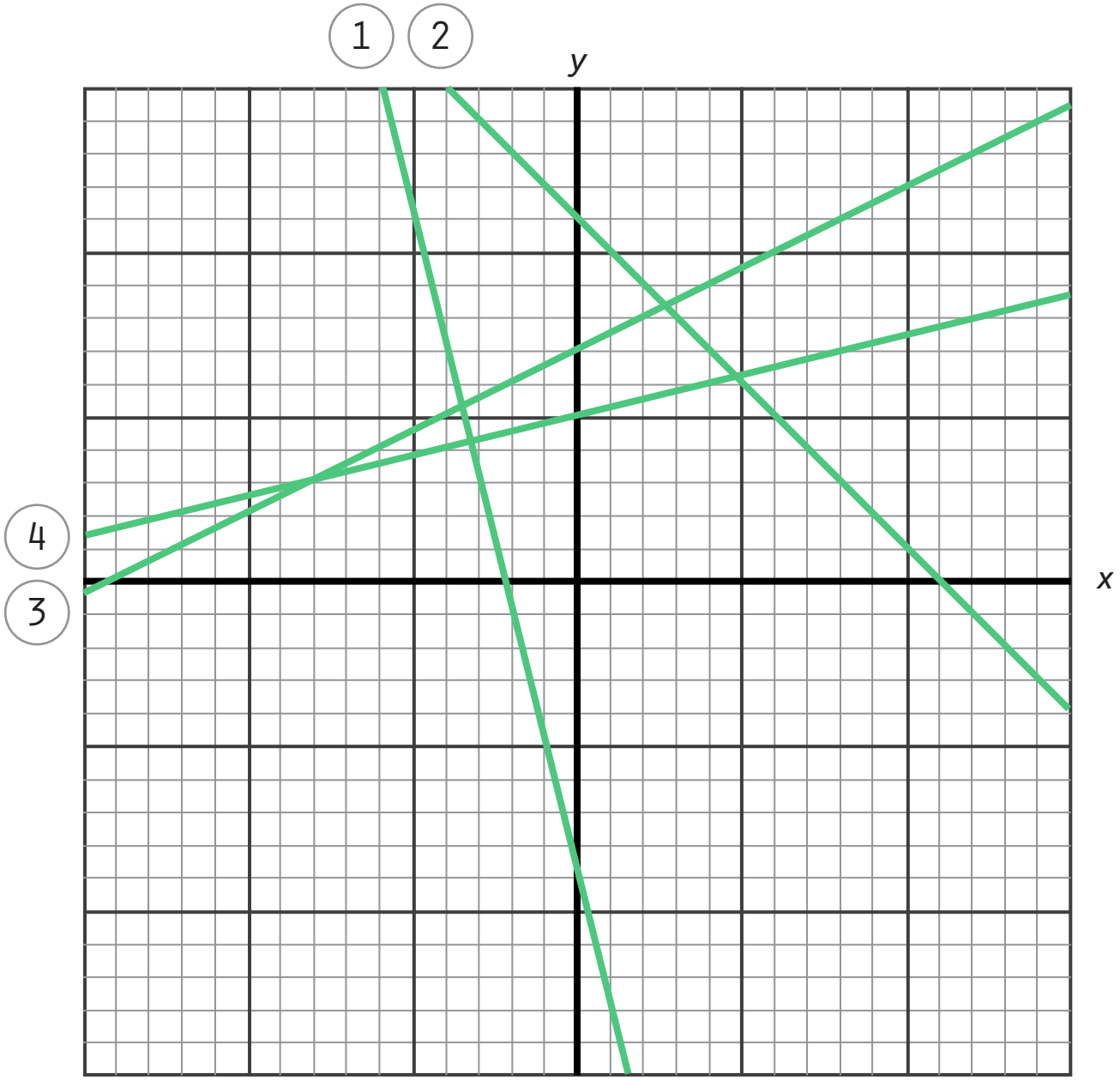

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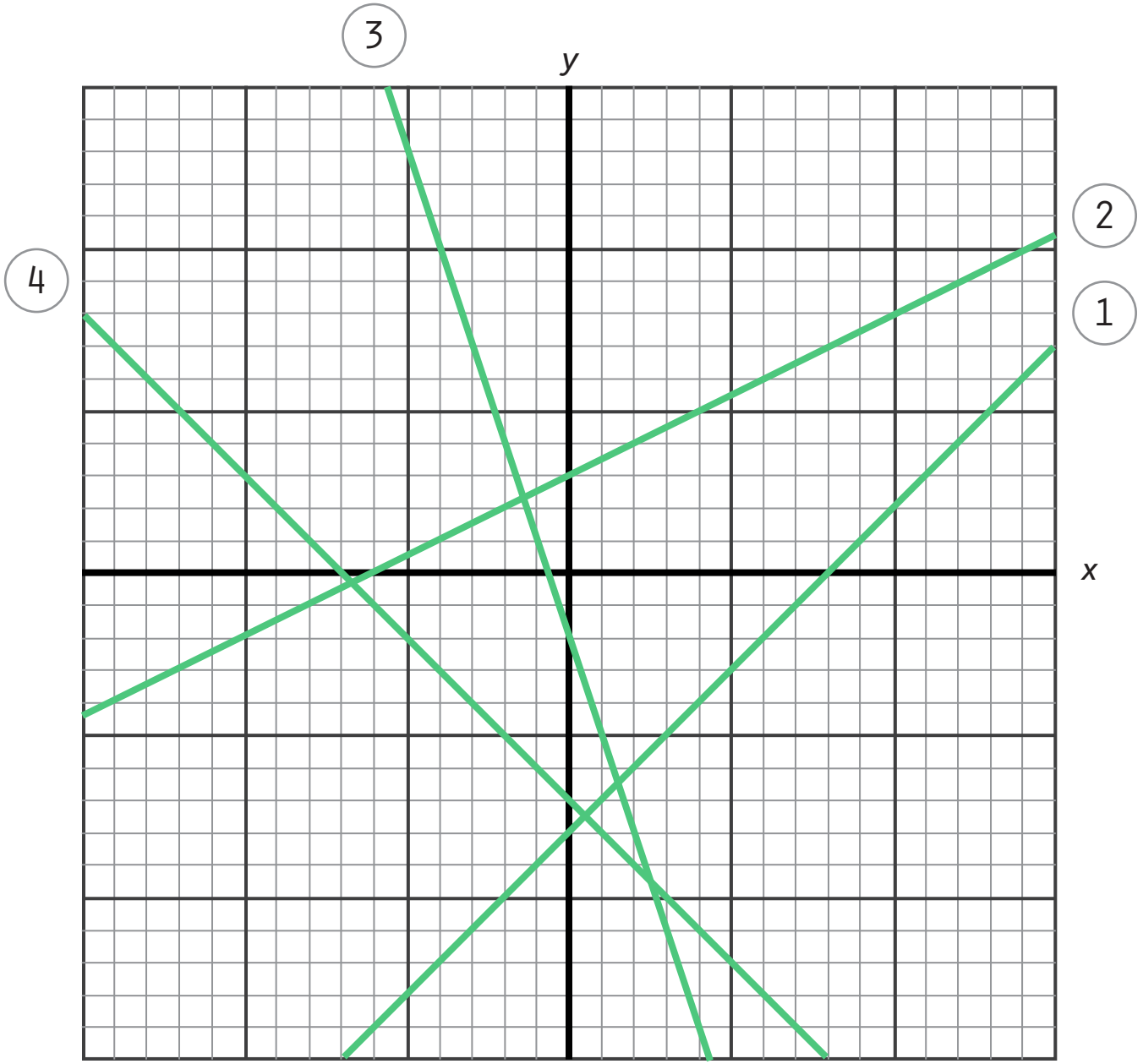

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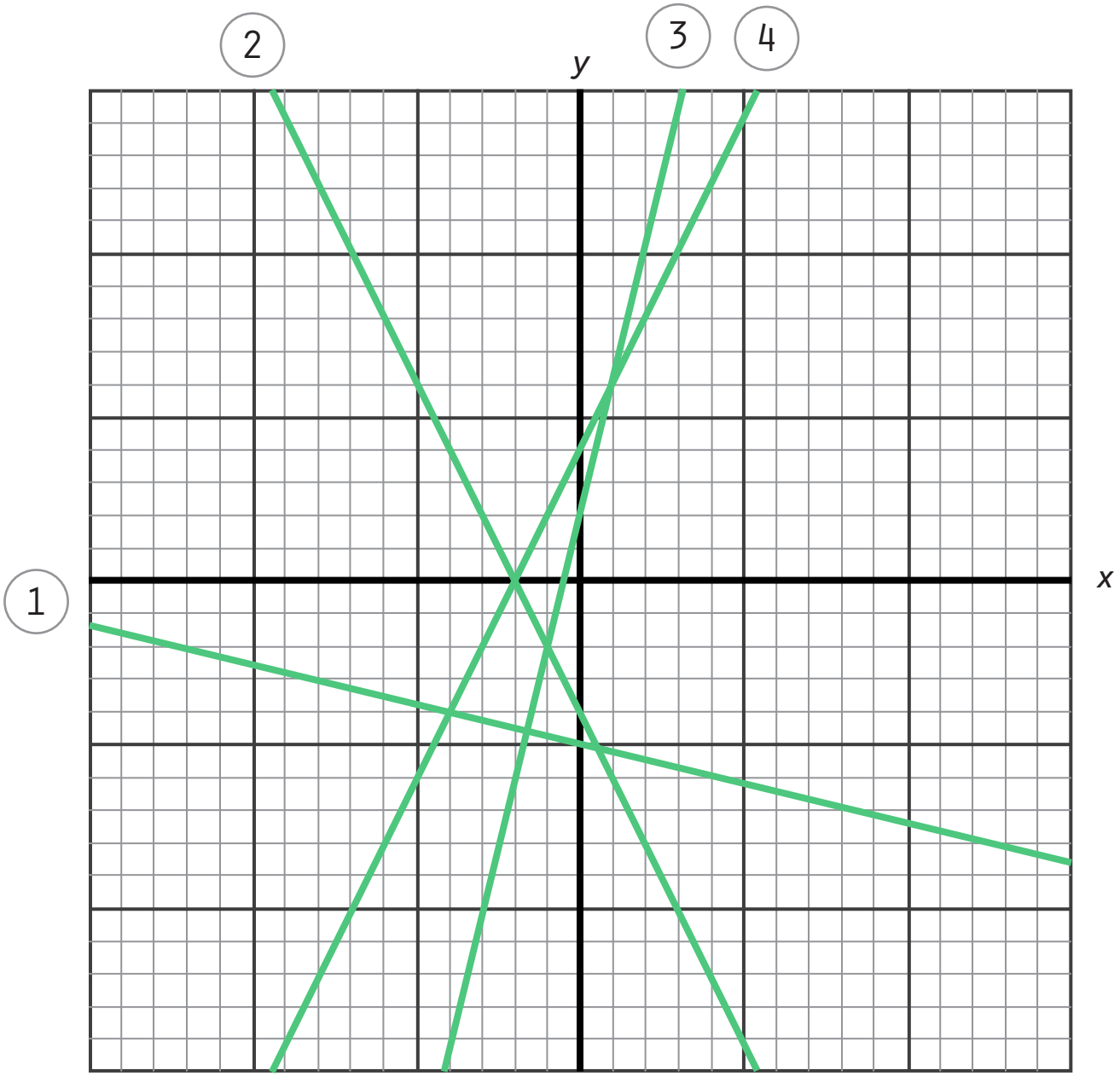

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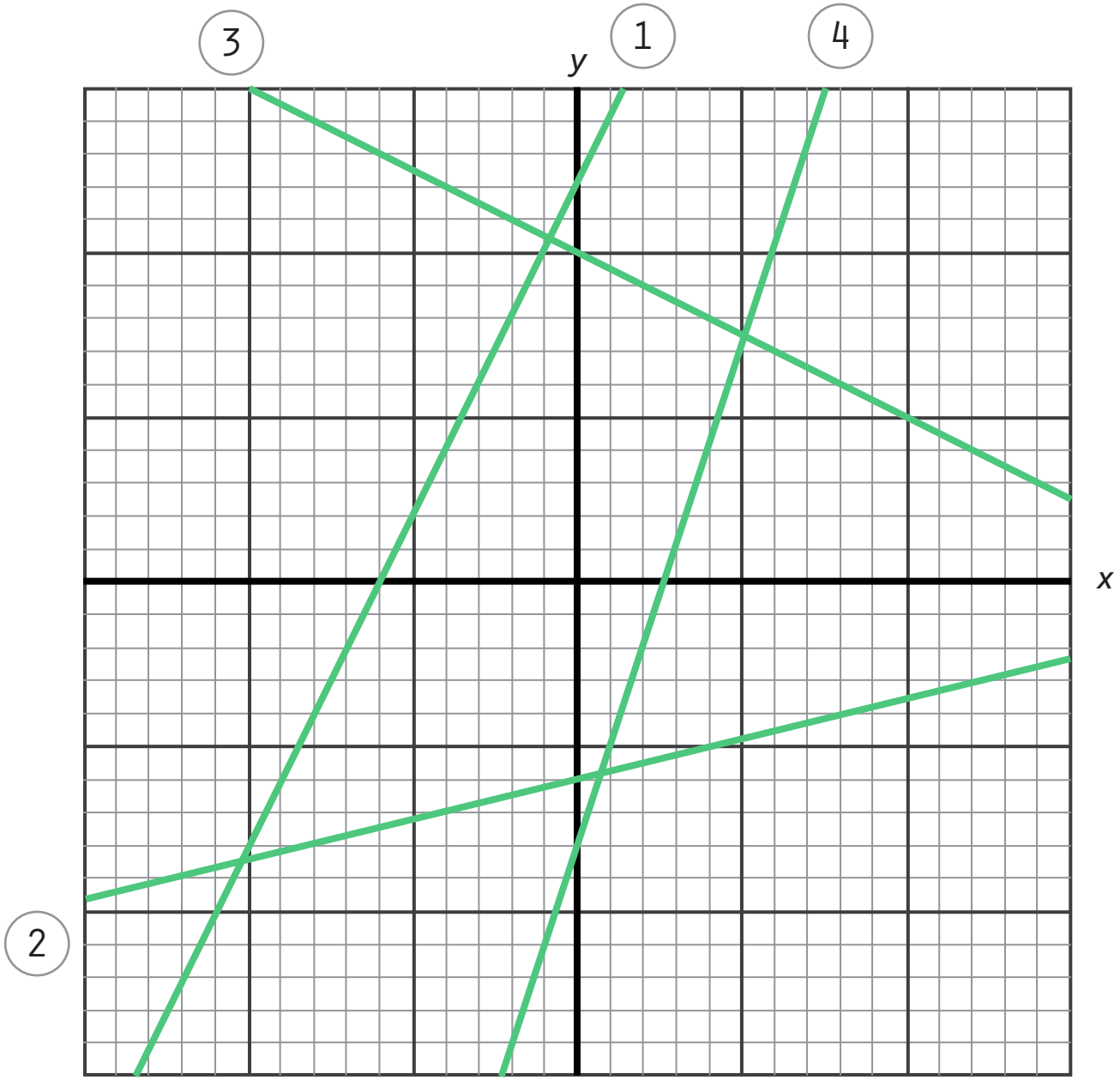


Module #5:

Dimensional Analysis

Dimensional Analysis

What is Dimensional Analysis?

These questions ask you to think about how one variable relates to or interacts with others in an equation. There are 3 possible variations you may see:

- Positive vs. negative
- Increase vs. decrease
- Try out each answer choice

We'll review approaches for each variation. You will see a total of 5 of these types of questions on your exam.

Positive vs. Negative

These questions will provide an equation consisting of multiple variables and will tell you that certain variables are positive or negative. The answer choices will ask you to determine whether the remaining variables are positive or negative.

How to approach:

- Note the information given about which variables are positive and negative directly on your equation.
- Write down whether each remaining variable could be positive or negative before you go to the answer choices.

Q1. $$W = \frac{QRX}{T}$$

In the formula above, if W is positive and R is negative, which of the following statements could be true?

A. T is positive and Q and X are negative.

B. T, Q, and X are negative.

C. T, Q, and X are positive.

D. T and Q are negative and X is positive.

Dimensional Analysis

Increase vs. decrease

These questions will provide an equation consisting of multiple variables and will tell you that a certain variable is increasing or decreasing, while the others may remain constant. The answer choices will ask you to determine what happens to a given variable as a result.

How to approach:

- Note the information given about which variables are increasing/decreasing/staying the same directly on your equation.
- Write down whether each remaining variable would increase/decrease/remain constant before you go to the answer choices.

Q2. $$C = \frac{yz}{wx}$$

In the formula above, if *w* increases while *x*, *y*, and *z* remain constant, which of the following statements about *C* is true?

A. *C* increases.

B. *C* becomes zero.

C. *C* decreases.

D. *C* does not change.

Dimensional Analysis

Try out each answer choice

These questions will provide an equation consisting of multiple variables and will ask you to evaluate what happens to one variable if another variable is assigned certain qualities (positive, negative, smaller than, greater than).

How to approach:

- As the name suggests, you will need to try out the condition given in each answer choice to see what happens. This takes a little more time, but you can use the answer choices to help you work efficiently.
- Pick a number for the variable that fits with the new information given and write down the number you try. If the outcome you get doesn't match what the answer choice says, eliminate the choice.
- Be sure to try out all the answer choices, eliminating each time you get a conflicting result.

Q3. $W = \frac{R}{3} - 2$

Which of the following statements is true for the formula above?

A. When the value of *R* is greater than 6, *W* is negative.

B. When the value of *R* is less than 6, *W* is positive.

C. When the value of *R* is greater than 3, *W* is positive.

D. When the value of *R* is less than 6, *W* is negative.

Dimensional Analysis Drill #1

1. $$R = \frac{P}{WV^2}$$

   In the formula above, if *R* is positive and W is negative, which of the following statements must be true?

   A. *V* is negative.

   B. *V* is positive.

   C. *P* is negative.

   D. *P* is positive.

2. $$A = \frac{BC}{D}$$

   In the formula above, if B is positive and *D* is negative, which of the following statements could be true?

   A. *A* is negative and *C* is negative.

   B. *A* is negative and *C* is positive.

   C. *A* and *C* are positive.

   D. *A*, *B*, and *C* are positive.

3. $$K = \frac{H^2}{JMP}$$

   In the formula above, if *K* is negative, which of the following statements could be true?

   A. *J*, *M*, and *P* are positive.

   B. *J* and *M* are negative and *P* is positive.

   C. *M* and *P* are negative and *J* is positive.

   D. *J* and *P* are positive and *M* is negative.

Dimensional Analysis Drill #1

4. $$v = \frac{wy}{r}$$

In the formula above, if *w* increases while *v* remains constant, which of the following statements could be true?

A. *y* and *r* remain constant.

B. *y* remains constant and *r* decreases.

C. *r* remains constant and *y* decreases.

D. *r* remains constant and *y* increases.

5. $T = VXY$

In the formula above, if *X* remains constant and *T* increases, which of the following statements could be true?

A. *V* increases and *Y* remains constant.

B. *V* decreases and *Y* remains constant.

C. *V* and *Y* decrease.

D. *Y* decreases and *V* remains constant.

6. $$w = \frac{25xr}{st}$$

In the formula above, if *w* and *s* remain constant and *x* decreases, which of the following statements could be true?

A. *r* decreases and *t* remains constant.

B. *r* increases and *t* remains constant.

C. *r* and *t* remain constant.

D. *t* increases and *r* remains constant.

Dimensional Analysis Drill #1

7. $x = 5w - 3$

Which of the following statements is true for the formula above?

A. If w is greater than 1, then x is negative.

B. If w is negative, then x is positive.

C. If w is negative, then x is negative.

D. If w is greater than 3, then x is negative.

8. $$B = 10 - \frac{C}{4}$$

Which of the following statements is true for the formula above?

A. If C is greater than 40, then B is positive.

B. If C is less than 40, then B is negative.

C. If C is less than 20, then B is negative.

D. If C is greater than 40, then B is negative.

9. $7t - 1 = r$

Which of the following statements is true for the formula above?

A. When $t > 1$, $r < 0$.

B. When $t = 0$, $r = 0$.

C. When $t < 0$, $r > 0$.

D. When $t < 0$, $r < 0$.

10. $$f = \frac{gh}{5}$$

Which of the following statements is true for the formula above?

A. If g and h are each greater than 0, then f is greater than 0.

B. If $gh = 5$, then $f = 0$.

C. If g and h are each less than 0, then f is less than 0.

D. If g is greater than 0 and h is less than 0, then f is greater than 0.

Dimensional Analysis Drill #2

1. $$z = \frac{wx}{vy}$$

   In the formula above, if *w*, *x*, and *y* are all the same sign, which of the following statements could be true?

   A. *v*, *y*, and *z* are negative.

   B. *w*, *v*, and *z* are negative.

   C. *x* and *v* are positive and *z* is negative.

   D. *y* and *z* are negative and *v* is positive.

2. $G = F^2HJ$

   In the formula above, if *H* is negative, which of the following statements could be true?

   A. *G* and *J* are positive.

   B. *G*, *F*, and *J* are positive.

   C. *G* is negative and *J* is positive.

   D. *G* and *J* are negative.

3. $$N = \frac{RS^3}{T}$$

   In the formula above, if *N* and *T* are positive, which of the following statements could be true?

   A. *R* is positive and *S* is negative.

   B. *R* is positive and *S* is positive.

   C. *R* is negative and *S* is positive.

   D. *R* and *S* have opposite signs.

Dimensional Analysis Drill #2

4. $$c = \frac{bde}{af}$$

In the formula above, if *c* decreases and *b*, *d*, and *a* remain constant, which of the following statements could be true?

A. *e* increases and *f* decreases.

B. *e* and *f* both remain constant.

C. *e* remains constant and *f* increases.

D. *f* remains constant and *e* increases.

5. $$v = \frac{32x^2}{u}$$

In the formula above, if *x* remains constant, which of the following statements could be true?

A. If *u* increases, then *v* increases.

B. If *u* decreases, then *v* decreases.

C. If *u* decreases, then *v* does not change.

D. If *u* increases, then *v* decreases.

6. $$h = \frac{klm}{4n^2}$$

In the formula above, if $n > 1$ and increasing, and *k* and *l* are constant, which of the following statements could be true?

A. *m* increases and *h* remains constant.

B. *m* decreases and *h* increases.

C. *m* and *h* remain constant.

D. *m* remains constant and *h* increases.

Dimensional Analysis Drill #2

7. $Q = \frac{R}{4} - 7$

Which of the following statements is true for the formula above?

A. When $R > 28$, Q is negative.

B. When $R > 28$, Q is positive.

C. When $R < 28$, Q is positive.

D. When $R < 4$, Q is positive.

8. $w = 6t - 5$

Which of the following statements is true for the formula above?

A. When $t < 5/6$, w is negative.

B. When $t > 5/6$, w is negative.

C. When $t = 0$, w is positive.

D. When $t < 1/2$, w is positive.

9. $D = C^2 - 2A$

Which of the following statements is true for the formula above?

A. If $C > 2$ and $A < 2$, D is negative.

B. If $C < 2$ and $A > 2$, D is positive.

C. If $C < -2$ and $A < 2$, D is negative.

D. If $C < -2$ and $A > 2$, D is positive.

10. $y = 8n - \frac{x}{3}$

Which of the following statements is true for the formula above?

A. If $x > 3$ and $n > 2$, y is negative.

B. If $x = 3$ and $n < 0$, y is positive.

C. If $x > 3$ and $n < 1/8$, y is negative.

D. If $x > 6$ and $n < 1/4$, y is positive.

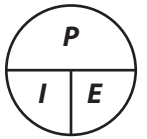
Volts	Ohms	Volts	Ohms
2	2.4	26	32.0
6	7.4	30	37.0
10	12.4	34	41.8
14	16.8	38	46.8
18	22.0	42	51.6
22	27.0		

Amps	Ohms	Amps	Ohms
4	50.0	26	7.7
6	33.3	30	6.7
10	20.0	34	5.9
14	14.3	38	5.3
18	11.1	42	4.8
22	9.1	46	4.3

Formulas

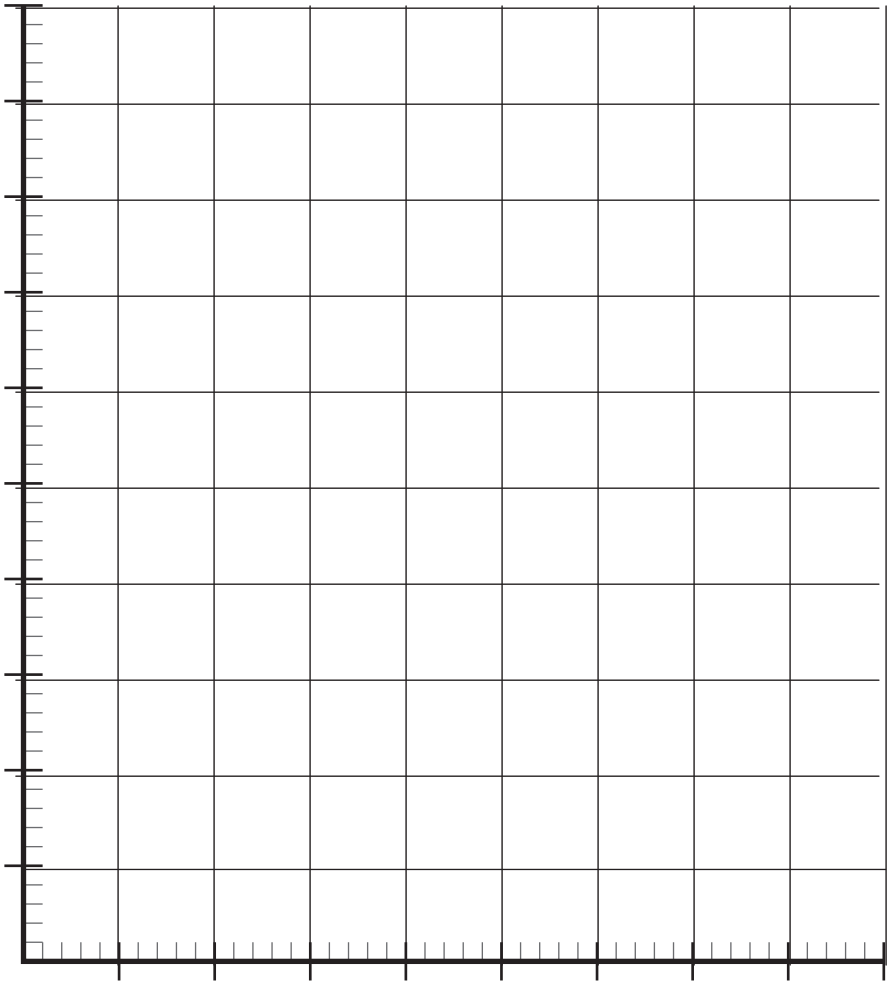
$E = I \times R$

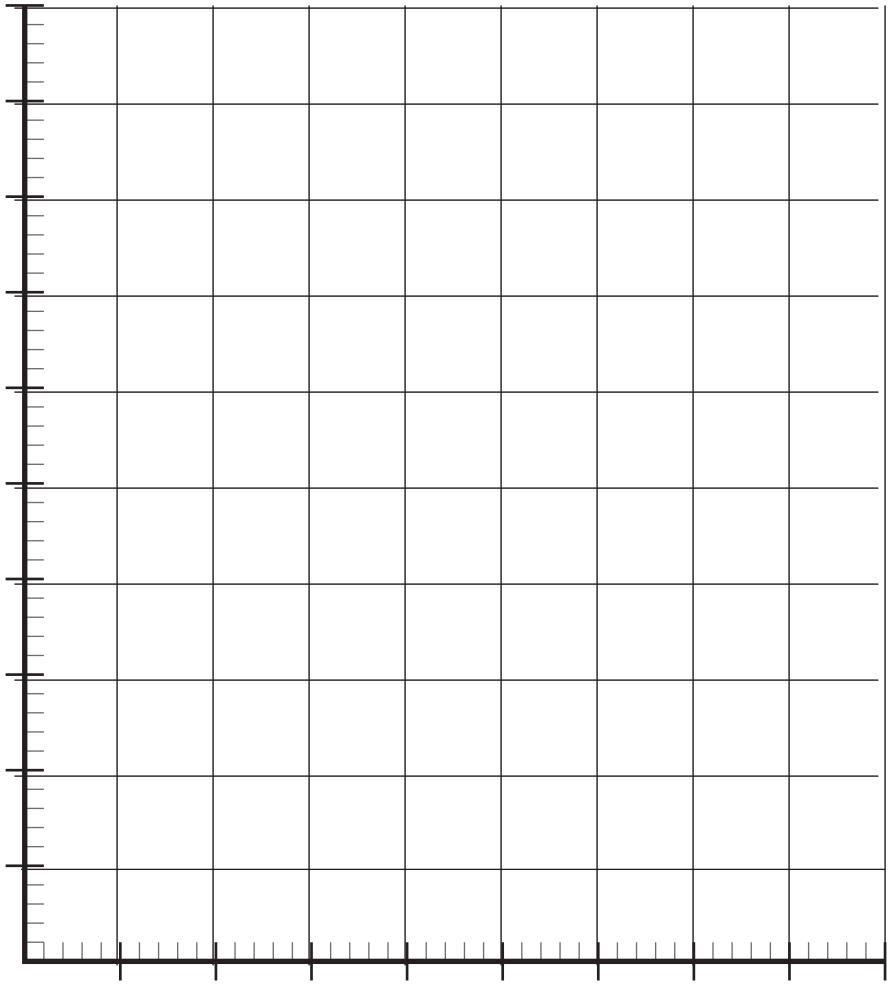
$I = \frac{E}{R}$ $R = \frac{E}{I}$



$P = I \times E$

$I = \frac{P}{E}$ $E = \frac{P}{I}$





Volts	Amps	Volts	Amps
4	50.0	26	7.7
6	33.3	30	6.7
10	20.0	34	5.9
14	14.3	38	5.3
18	11.1	42	4.8
22	9.1	46	4.3

Volts	Watts	Volts	Watts
2	2.3	26	29.3
6	6.8	30	33.8
10	11.3	34	38.3
14	15.8	38	42.8
18	20.3	42	47.3
22	24.8	46	51.8

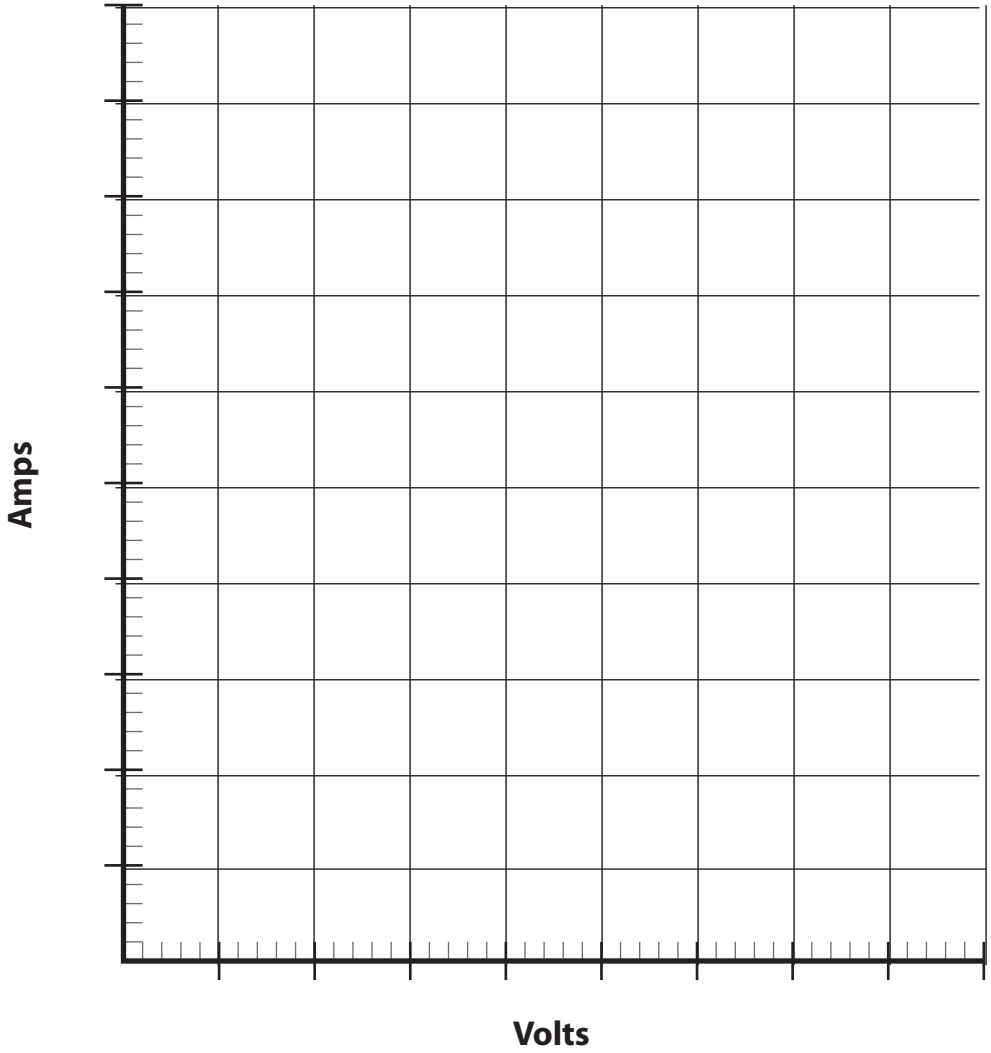
Formulas

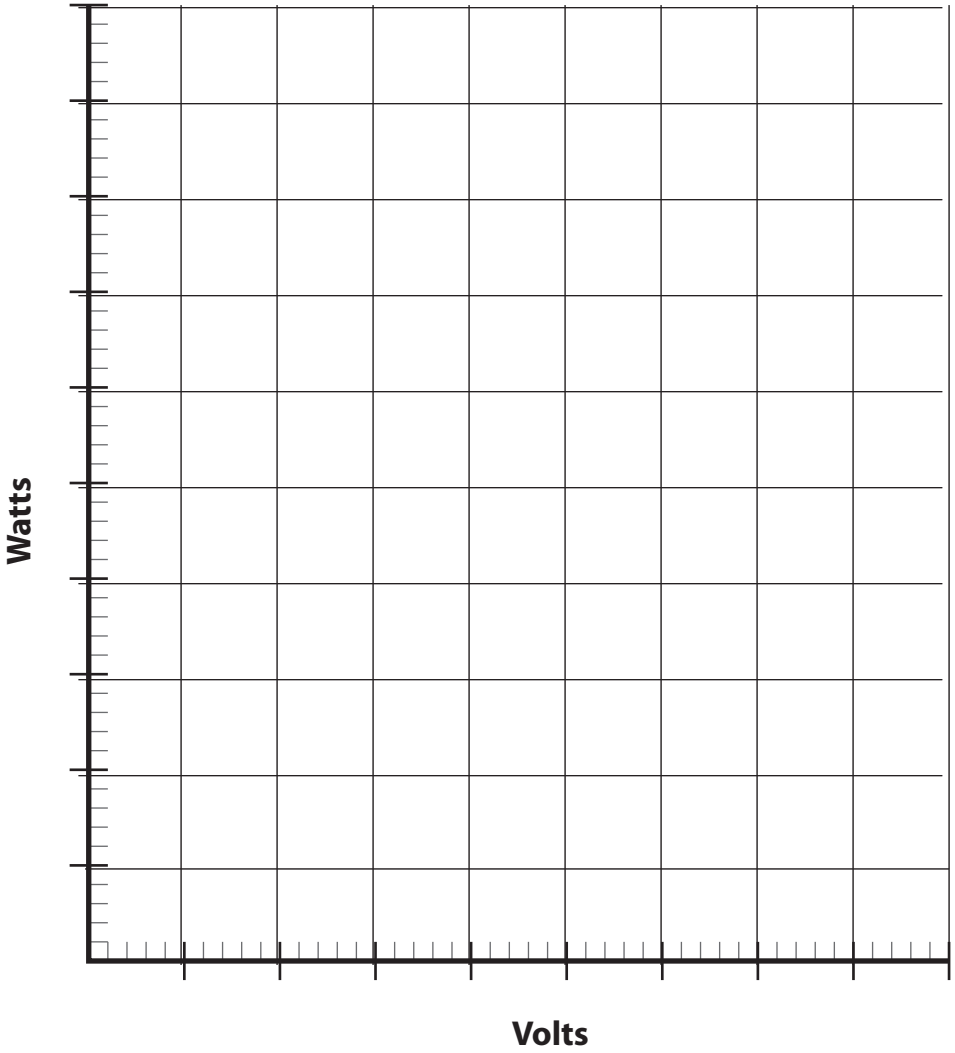
$E = I \times R$

$I = \frac{E}{R}$ $R = \frac{E}{I}$

$P = I \times E$

$I = \frac{P}{E}$ $E = \frac{P}{I}$





Mathematical Relationships

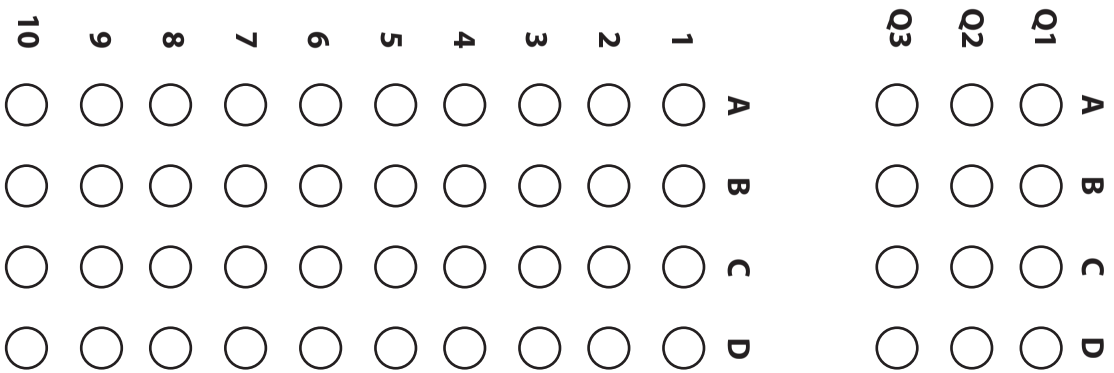
Direct Relationship

Inverse Relationship

Name: _____

Dimensional Analysis

Drill 1



Drill 2