

Name: _____



Park Forest/Chicago Heights
School District 163
Summer Learning Packet

Entering 6th

*Please complete this packet during your summer break and turn it in on the first day of school to qualify for the incentive.

Contents include: Math Fluency, TTM Requirements, Math Activities, Reading Log, *New Kid* Graphic Novel Activities, Social Studies, Science Enrichment Activities.

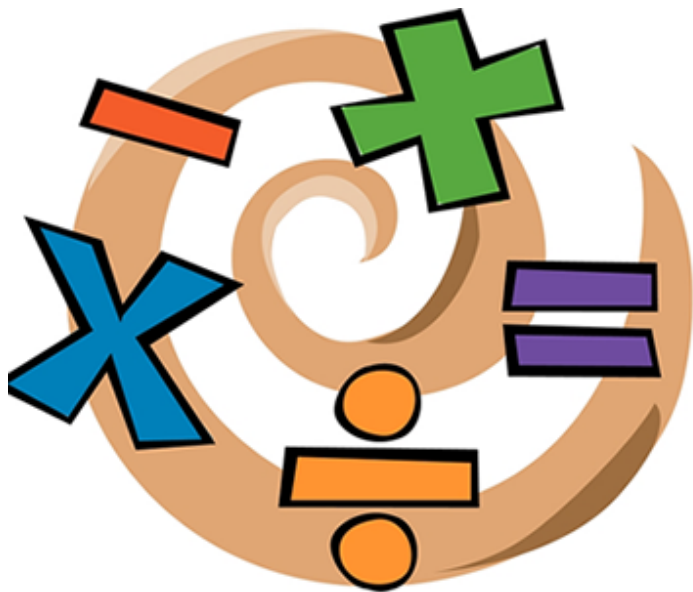
Think Through Math Summer Requirements



All students are required to pass their pathway over the summer. Students will use the same login and password information. The expectation is for every student to pass two lessons per week until they complete/pass their summer pathway.



Math Fluency



Practicing
Math
Fluency
Skills



Name _____

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Answer as many problems as you can in 2 minutes.





Name _____

$5 \overline{)20}$ $3 \overline{)6}$ $2 \overline{)10}$ $8 \overline{)16}$ $9 \overline{)18}$ $3 \overline{)9}$ $7 \overline{)42}$ $4 \overline{)12}$ $9 \overline{)27}$ $7 \overline{)56}$

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Answer as many problems as you can in 2 minutes.



Addition

Find the sum of the two numbers in each problem.
Show all work.

Example:

$$\begin{array}{r} 1 \ 1 \\ 4 \ 4 \ 8 \\ + 1 \ 8 \ 8 \\ \hline 6 \ 3 \ 6 \end{array}$$

1. $\begin{array}{r} 652 \\ + 345 \\ \hline \end{array}$

2. $\begin{array}{r} 203 \\ + 525 \\ \hline \end{array}$

3. $\begin{array}{r} 726 \\ + 268 \\ \hline \end{array}$

Decimal Addition:

Remember to line up the decimals before adding. Bring the decimal straight down in your answer.

4. $\begin{array}{r} 7.75 \\ + 1.46 \\ \hline \end{array}$

5. $51.4 + 2.86$

6. $.1274 + 8.25$

Subtraction

Find the difference between the two numbers in each problem. Show all work.

Example:

$$\begin{array}{r} 3 \ 13 \\ 7 \ ~~4~~ \ ~~8~~ \\ - 2 \ 1 \ 8 \\ \hline 5 \ 2 \ 5 \end{array}$$

7. $\begin{array}{r} 407 \\ - 198 \\ \hline \end{array}$

8. $\begin{array}{r} 7,007 \\ - 2,426 \\ \hline \end{array}$

9. $\begin{array}{r} 3,414 \\ - 1,218 \\ \hline \end{array}$

Decimal Subtraction:

Remember to line up the decimals before subtracting. Bring the decimal straight down in your answer.

10. $\begin{array}{r} 338.38 \\ - 149.27 \\ \hline \end{array}$

11. $80.401 - 44.23$

12. $75.89 - 9.4$

Multiplication

Find the product of the two numbers in each problem. Show all work.

Example:

$$\begin{array}{r} 54 \\ \times 16 \\ \hline 324 \\ + 540 \\ \hline 864 \end{array}$$

13.

$$\begin{array}{r} 65 \\ \times 4 \\ \hline \end{array}$$

14.

$$\begin{array}{r} 42 \\ \times 8 \\ \hline \end{array}$$

15.

$$\begin{array}{r} 84 \\ \times 39 \\ \hline \end{array}$$

Decimal Multiplication:

Multiply as you would with whole numbers. Count the decimal places in each factor. The product (answer) has the same number of decimal places.

16.

$$\begin{array}{r} .13 \\ \times 70 \\ \hline \end{array}$$

17.

$$\begin{array}{r} 5.1 \\ \times 2 \\ \hline \end{array}$$

18.

$$\begin{array}{r} .108 \\ \times 2.5 \\ \hline \end{array}$$

Division

Find the quotient in each problem. If there is a remainder, state the remainders as R=____. Show all work. Feel free to use a separate sheet of paper.

19.

$$7 \overline{)591}$$

20.

$$12 \overline{)264}$$

21.

$$43 \overline{)2815}$$

Decimal Division:

If the divisor (outside number) is a decimal, you must move the decimal point (using multiplication) to the right until it becomes a whole number. Then, move the decimal in the dividend (inside number) the same number of times. Divide to find your answer (quotient).

Then, move the decimal straight up from the dividend to the quotient.

Remember, no remainders.

$$\begin{array}{r} \text{quotient} \\ \text{divisor} \overline{) \text{dividend}} \end{array}$$

22.

23.

24.

$$3 \overline{) 31.8}$$

$$.5 \overline{) 7.45}$$

$$.12 \overline{) 12.24}$$

Rounding

Underline the given place value. Look to the right. If this digit is 5 or greater, increase the underlined digit by 1. If the digit to the right is less than 5, keep the underlined digit the same.

Round to the nearest...

hundredth

0.547 → 0.55

Round to the nearest....

25. tenth
0.3479

26. hundredth
0.7553

27. whole number
3.268

28. ten
162.21

29. thousandth
0.0036

30. hundred
990.54

Compare the decimals.

Compare using $<$, $>$, or $=$

1.2 ○ 1.20 1.2 = 1.20

31. 0.205 ○ 0.21

32. 1.03 ○ 0.03

33. 0.04 ○ 0.050

34. 0.1 ○ 0.1000

35. 0.52 ○ 0.500

36. 0.41 ○ 0.405

Prime Number: A whole number greater than 1 that has only two factors, 1 and itself.
Examples: 2, 3, 5, 7, 11, 13, 17, and 19 are all prime numbers.

Composite Number: A whole number greater than 1 that has more than two factors.
Example: 8 is a composite number since its factors are 1, 2, 4, 8.

Determine if the following numbers are prime or composite. If the numbers are composite, please list all of the factors.

37. 27: _____

38. 39: _____

39. 43: _____

40. 49: _____

Exponents

A way to show repeated multiplication by the same factor is to use an exponent. In this example: $2^3 = 2 \times 2 \times 2 = 8$. The small raised three is the exponent. It tells how many times the number 2, called the base, is multiplied by itself.

Solve the following expressions by writing the expanded notation (repeated multiplication) and find the value.

41. 6^2

42. 2^6

43. 3^4

44. eight squared

45. five cubed

Greatest Common Factor

The greatest factor that two or more numbers have in common (*GCF*).

1. List all the factors of **four** in order
2. List all the factors of **twenty** in order
3. List the common factors
4. Write the greatest common factor

Finding Common Factors:

4: 1, 2, 4

20: 1, 2, 4, 5, 10, 20

Common Factors: 1, 2, 4 *GCF* = 4

List all the factors for each number. Circle the common factors.

46. 18 : _____

30 : _____

Common Factors: _____ Greatest Common Factor: _____

47. 60 : _____

45 : _____

Common Factors: _____ Greatest Common Factor: _____

48. 23: _____

29: _____

Common Factors: _____ Greatest Common Factor: _____

49. 56: _____

72: _____

Common Factors: _____ Greatest Common Factor: _____

Least Common Multiple

The smallest nonzero multiple that two or more numbers have in common.

1. List the first 6 multiples of 4
2. List the first 6 multiples of 6
3. List the common multiples
4. Write the least common multiple.

Finding Common Multiples:

4: **4, 8, 12, 16, 20, 24**

6: **6, 12, 18, 24, 30, 36**

Least Common Multiple= 12

50. 8 : _____

12 : _____

Common Multiples: _____ Least Common Multiple: _____

51. 7 : _____

11 : _____

Common Multiples: _____ Least Common Multiple: _____

52. 25 : _____

10 : _____

Common Multiples: _____ Least Common Multiple: _____

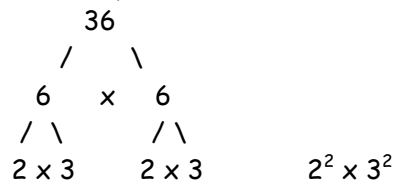
53. 24 : _____

36: _____

Common Multiples: _____ Least Common Multiple: _____

Prime Factorization is a composite number renamed as a product of prime numbers. You may make a factor tree to find the answer. Put final answer in exponent form.

Find the prime factorization of 36.



54.

180

55.

525

56.

91

57.

48

Comparing Fractions

Compare each pair of numbers. Write the correct comparison symbol ($<$, $>$, $=$) in each circle. Make sure you have common denominators before comparing numerators.

Example:

$$\begin{array}{ccc} \frac{1}{3} & \bigcirc & \frac{3}{4} \\ \downarrow & & \downarrow \\ \frac{4}{12} & & \frac{9}{12} \end{array}$$

58.

$$\frac{3}{8} \bigcirc \frac{5}{8}$$

59.

$$\frac{3}{4} \bigcirc \frac{3}{8}$$

60.

$$\frac{1}{2} \bigcirc \frac{4}{8}$$

61.

$$\frac{3}{7} \bigcirc \frac{1}{4}$$

62.

$$\frac{3}{5} \bigcirc \frac{5}{6}$$

63.

$$\frac{7}{8} \bigcirc \frac{3}{4}$$

Ordering Fractions

Order the following fractions from **least to greatest**.

64.

$$\frac{3}{8} \quad \frac{5}{8} \quad \frac{4}{8} \quad \frac{2}{8} \quad \frac{7}{8}$$

65.

$$\frac{1}{5} \quad \frac{4}{5} \quad \frac{1}{10} \quad \frac{6}{10} \quad \frac{7}{10}$$

66.

$$\frac{1}{2} \quad \frac{1}{4} \quad \frac{1}{6} \quad \frac{1}{3} \quad \frac{1}{5}$$

67.

$$\frac{1}{2} \quad \frac{5}{16} \quad \frac{30}{64} \quad \frac{3}{8} \quad \frac{9}{32}$$

Order of Operations

Solve the following problems. Show your work. Be sure to follow the order of operations.

Parenthesis

Exponents

Multiplication or Division: Which ever comes first from left to right.

Addition or Subtraction: Which ever comes first from left to right.

Example: $8 - 4 \div 2 + 2 =$
 $8 - 2 + 2 =$
 $6 + 2 =$
 8

68. $15 \times 8 - 3 =$

69. $36 \div 4 \times 3 =$

70. $(30 + 8) \times 6 - 1 =$

71. $(30 + 8) \times (6 - 1) =$

72. $(29 - 18) + 14 \div 2 + 6 =$

73. $64 \div 8 \times 2$

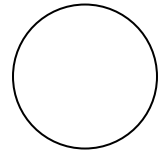
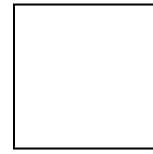
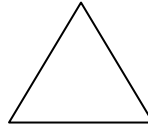
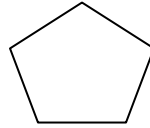
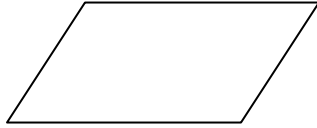
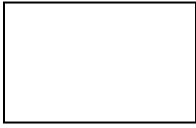
74. $36 - 5(16 - 11) =$

75. $25 + 18 \div 6 - 1 =$

76. $24 + 6^2 - 1^4 =$

Geometry-Who am I?

Use the following shapes to answer the questions below.



77. I am a 2 dimensional shape that has four sides. I have four 90 degree angles. I have two sets of parallel lines. I also have two sides that are one length, and my other two sides are a different length.

Who am I? _____

78. I am a 2 dimensional shape that has three acute angles. All of my sides are the same length. I have no parallel sides.

Who am I? _____

79. I am a 2 dimensional shape that has four sides. I have two obtuse angles and two acute angles. I have two different sets of parallel sides. I also have two sides that are one length, and my other two sides are a different length.

Who am I? _____

80. I am a 2 dimensional shape that has 5 obtuse angles. I do not have any sides that are parallel.

Who am I? _____

81. I am a 2 dimensional shape that has four 90 degree angles. I have four sides that are all the same length. I have two different sets of parallel lines.

Who am I? _____

82. I am a 2 dimensional shape. My perimeter is also known as a circumference.

Who am I? _____

Simply Fractions

Simplify the following fractions. If the fractions are improper, change them to mixed numbers then simplify.

Example: $\frac{10}{25} \div 5 = \frac{2}{5}$

83.

$$\frac{14}{28}$$

84.

$$\frac{15}{55}$$

85.

$$\frac{12}{51}$$

86.

$$\frac{34}{48}$$

87.

$$\frac{17}{4}$$

88.

$$\frac{80}{25}$$

Adding Fractions and Mixed Numbers

Add the following fractions. Make sure you have common denominators before adding. Remember, you only add the numerator (top number) and you keep the denominator (bottom number) the same! Simplify your final answers.

Example:

$$\begin{array}{r} \frac{1}{3} + \frac{1}{5} = \\ \downarrow \quad \downarrow \\ \frac{5}{15} + \frac{3}{15} = \frac{8}{15} \end{array}$$

89.

$$\frac{6}{10} + \frac{3}{10} =$$

90.

$$2\frac{3}{8} + 1\frac{2}{8} =$$

91.

$$\frac{1}{9} + \frac{5}{6} =$$

92.

$$\frac{1}{12} + 1\frac{2}{3} =$$

Subtracting Fractions

Subtract the following fractions. Make sure you have common denominators before subtracting. Remember, you only subtract the numerator (top number) and you keep the denominator (bottom number) the same! Simplify your final answers.

93.

$$\frac{5}{6} - \frac{3}{6} =$$

94.

$$2\frac{8}{12} - 1\frac{3}{12} =$$

Example:

$$\begin{array}{r} \frac{5}{6} - \frac{1}{3} = \\ \downarrow \quad \downarrow \\ \frac{5}{6} - \frac{2}{6} = \frac{3}{6} = \frac{1}{2} \end{array}$$

95.

$$\frac{7}{10} - \frac{2}{4} =$$

96.

$$3\frac{4}{5} - \frac{1}{4} =$$

Multiplying Fractions

Multiply the following fractions. Multiply the numerators; then multiply the denominators. Simplify, if necessary.

97.

$$\frac{3}{4} \times \frac{1}{3} =$$

98.

$$\frac{2}{3} \times \frac{5}{8} =$$

99.

$$\frac{1}{3} \times \frac{2}{5} =$$

100.

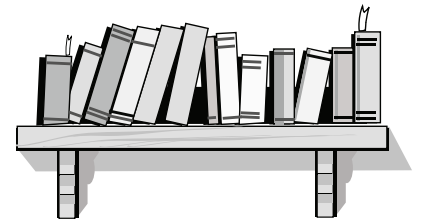
$$\frac{7}{8} \times 2 =$$

Example:

$$\frac{3}{5} \times \frac{5}{9} = \frac{15}{45} = \frac{1}{3}$$



Reading Log



Name: _____

Month: _____

Name of book	Author	Date	Number of pages	Comments



Reading Log



Name: _____

Month: _____

Name of book	Author	Date	Number of pages	Comments

New Kid by Jerry Craft



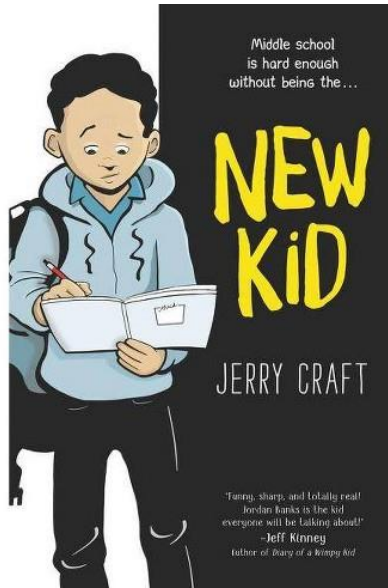
WEEK OF JUNE 1, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

HAPPY READING FROM YOUR ELA TEACHERS!!!!!!!!!!!!

Student Signature _____

Parent Signature _____



DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF JUNE 8, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

Parent Signature _____

DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF JUNE 15, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.



Student Signature _____

Parent Signature _____

DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF JUNE 22, 2020



Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

Parent Signature _____



DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF June 29, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

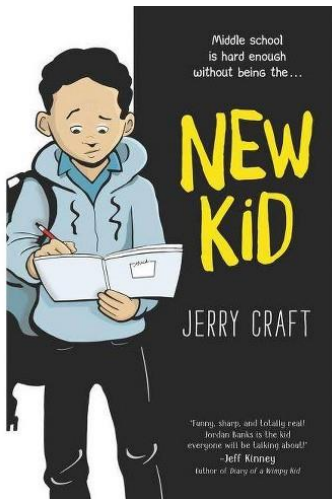
Parent Signature _____

DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF JULY 6, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.



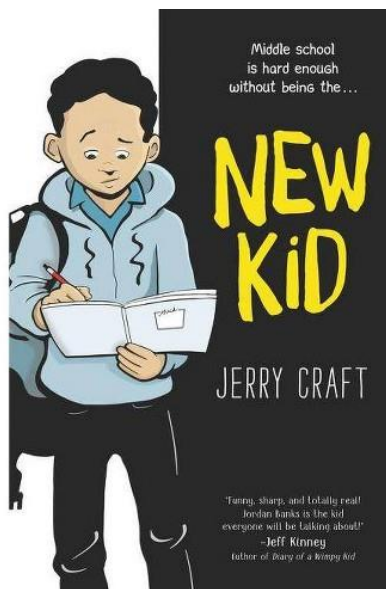
Student Signature _____

Parent Signature _____

DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF JULY 13, 2020



Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

Parent Signature _____



DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF JULY 20, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

Parent Signature _____



DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF JULY 27, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

Parent Signature _____

DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF AUGUST 3, 2020



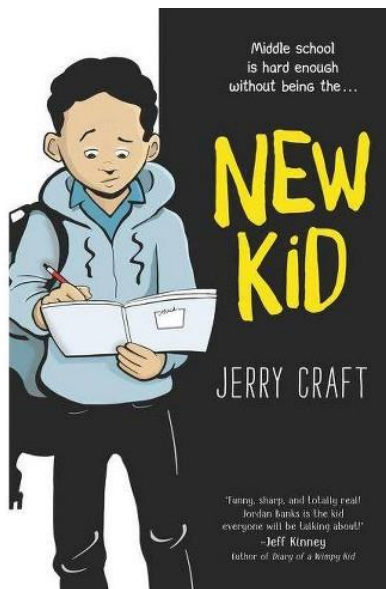
Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

Parent Signature _____

DROP EVERYTHING AND READ

New Kid by Jerry Craft



WEEK OF AUGUST 10, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

Parent Signature _____



DROP EVERYTHING AND READ

New Kid by Jerry Craft

WEEK OF AUGUST 17, 2020

Drop everything and read your new graphic novel, **New Kid**. Silently read for 120 minutes. After reading, select four activities from the choice board to complete in your reading notebook.

Student Signature _____

Parent Signature _____

Tic-Tac-Toe Book Activities

(Choice Grid I)

Use this grid to choose 3 activities for your book. The 3 activities you choose must be in a row, across, down, or diagonally. Circle your 3 choices. Be sure to put the title of the book and your name on each activity you complete. Return this sheet with your 3 activities.



Write a letter to one of the characters in the book. Discuss at least three events from the book in your letter.

Make a T-Chart with "Same" on one side, and "Different" on the other. Then use the chart to compare yourself to the main character. List at least 6 examples on each side.

Write a paragraph summarizing your favorite part of the book. Then write another paragraph telling why it is your favorite part. Include an illustration.

Fold a piece of paper so that there are 4 sections. Label the sections: Main Character, Setting, Plot, and My Opinion. Write 3 to 5 sentences in each section.

Write a one-sentence summary for each chapter in your book.

Create a word search using important words from your book. Include at least 15 words. Hint: Make the word list first, then use graph paper to make the puzzle.

Find 10 interesting words from your book. Write an original sentence about the book for each word. Make sure you don't copy or reword the author's sentences.

Add an event to your book. Write about the event in the style that the author used. Be sure to tell where in the book your event would occur. Illustrate your event.

Write 3 open-ended interview questions for the main character of your book. Then answer the questions as if you were the character.

Book Title: _____

Date due: _____

Signature: _____

Tic-Tac-Toe Book Activities

(Choice Grid 2)

Use this grid to choose 3 activities for your book. The 3 activities you choose must be in a row, across, down, or diagonally. Circle your 3 choices. Be sure to put the title of the book and your name on each activity you complete. Return this sheet with your 3 activities.



Create a timeline for the important events in your book. Illustrate at least 3 of the events.

Find a place in your book where a character makes an important choice. Write a paragraph about how the book would change if the character had made a different choice.

Write a paragraph telling what the main character in your book might be doing ten years in the future. Illustrate your paragraph.

Write a sentence about your book starting with each letter of the alphabet. You should have 26 sentences when you are done. You may have to be creative with "X"!

Pick out 3 personality traits the main character of your book possesses (such as mean, helpful, or honest). Then write examples to show how the character displays each of these

Make a Venn Diagram with 2 circles. Use the diagram to compare yourself to the main character in your book. Include at least 12 describing traits.

Find 5 words in this book that you do not know. Write dictionary definitions for each word and then use each word in a sentence.

Write a letter to the author of the book telling him or her how you felt about the book. Ask at least 3 questions about the book.

Pretend you are going to join the main character in the story for a day. Write a journal entry about the day. Illustrate your entry.

Book Title: _____

Date due: _____ Signature: _____

Tic-Tac-Toe Book Activities

(Choice Grid 3)



Use this grid to choose 3 activities for your book. The 3 activities you choose must be in a row, across, down, or diagonally. Circle your 3 choices. Be sure to put the title of the book and your name on each activity you complete. Return this sheet with your 3 activities.

<p>Write 6 challenging math word problems using characters and events from your book. Then solve each of the problems.</p>	<p>Make a list of at least 5 ways that your book would be different if it were set 100 years in the past. Then illustrate one of them.</p>	<p>Make a T-Chart. On one side write "I Know." On the other side write "I Think." Fill in the chart with at least 5 examples on each side about the main character of your book.</p>
<p>Create a map of an important setting in the book. Include labels or a map key to show important locations from the book. Then write a caption for your map.</p>	<p>Pick an eventful or exciting part of your book. Then write a journal entry about the event as if you were the character experiencing it.</p>	<p>Make a comic for one of the chapters of your book. Use pictures, captions, and speech bubbles to tell the story.</p>
<p>Write a new ending for this book. It should be at least a page long. Illustrate your ending.</p>	<p>Pretend you are going to join the main character in the story for a week. Make a list of everything you will need to pack to bring with you.</p>	<p>Create a multiple choice test for this book. Include at least 10 questions on your test.</p>

Book Title: _____

Date due: _____ Signature: _____

Tic-Tac-Toe Book Activities

(Choice Grid 4)

Use this grid to choose 3 activities for your book. The 3 activities you choose must be in a row, across, down, or diagonally. Circle your 3 choices. Be sure to put the title of the book and your name on each activity you complete. Return this sheet with your 3 activities.



Write a poem about a character or event in your book. Your poem should be at least 16 lines long.

Pretend you are going to write a sequel to this book. Write a paragraph that summarizes the plot of this new book. Illustrate your paragraph.

Make a crossword puzzle using important words from your book. Include at least 10 words. Hint: Make the puzzle on graph paper, then write the clues.

Pretend you are going to give a character in your story a gift - something he or she will really like. Draw a picture of the gift and write a paragraph explaining why the character will like it.

Make a Top Ten list of events from your book in order of importance to the story. The most important event should be #1.

Make a "Wanted" poster for one of the characters in your book. Tell what he/she is wanted for. This will work especially well with an evil or mean character.

Choose 3 adjectives that describe your book. Then give examples from the book that show why you chose each adjective.

Write 6 questions about your book. Start each question with: who, what, where, when, why and how. Answer your questions.

Write a book review for your book. First summarize the book, then tell how you felt about it. You may want to include stars, thumbs up/down, or some other rating system.

Book Title: _____

Date due: _____ Signature: _____

Tic-Tac-Toe Book Activities

(Choice Grid 5)

Use this grid to choose 3 activities for your book. The 3 activities you choose must be in a row, across, down, or diagonally. Circle your 3 choices. Be sure to put the title of the book and your name on each activity you complete. Return this sheet with your 3 activities.



<p>List all of the supporting characters and tell how each of them is related to the main character. Then write a sentence about each character. You may want to use a 3 column chart.</p>	<p>Write a paragraph about the title of your book. Explain why you think it is a good title or a bad title. Then create a new title for the book and explain why you think it is a good title.</p>	<p>Make a list of "favorites" (such as color, sport, animal, food, etc.) for the main character of your book. Include at least 15 favorites. Use your imagination!</p>
<p>Draw pictures of at least 8 important objects from your book. Then write a sentence explaining why each object is important to the story.</p>	<p>Pretend you are going to spend the day with the main character of your book. Write a story about what you would do together.</p>	<p>Write a letter to a friend about your book. Give your friend at least 3 reasons why he or she should read the book. Include an illustration.</p>
<p>Write a true/false test for this book. Include at least 20 questions.</p>	<p>Write a summary of your book using exactly 60 words. You will probably need to write several rough drafts before you get a summary you are happy with.</p>	<p>Write a paragraph describing the main character of your book. Then draw a detailed picture of him or her.</p>

Book Title: _____

Date due: _____

Signature: _____

Tic-Tac-Toe Book Activities

All 45 activities in list format

1. Write a letter to one of the characters in the book. Discuss at least three events from the book in your letter.
2. Make a T-Chart with "Same" on one side, and "Different" on the other. Then use the chart to compare yourself to the main character. List at least 6 examples on each side.
3. Write a paragraph summarizing your favorite part of the book. Then write another paragraph telling why it is your favorite part. Include an illustration.
4. Fold a piece of paper so that there are 4 sections. Label the sections: Main Character, Setting, Plot, and My Opinion. Write 3 to 5 sentences in each section.
5. Write a one-sentence summary for each chapter in your book.
6. Create a word search using important words from your book. Include at least 15 words. Hint: Make the word list first, then use graph paper to make the puzzle.
7. Find 10 interesting words from your book. Write an original sentence about the book for each word. Make sure you don't copy or reword the author's sentences.
8. Add an event to your book. Write about the event in the style that the author used. Be sure to tell where in the book your event would occur. Illustrate your event.
9. Write 3 open-ended interview questions for the main character of your book. Then answer the questions as if you were the character.
10. Create a timeline for the important events in your book. Illustrate at least 3 of the events.
11. Find a place in your book where a character makes an important choice. Write a paragraph about how the book would change if the character had made a different choice.
12. Write a paragraph telling what the main character in your book might be doing ten years in the future. Illustrate your paragraph.
13. Write a sentence about your book starting with each letter of the alphabet. You should have 26 sentences when you are done. You may have to be creative with "X"!
14. Pick out 3 personality traits the main character of your book possesses (such as mean, helpful, or honest). Then write examples to show how the character displays each of these traits.

15. Make a comic for one of the chapters of your book. Use pictures, captions, and speech bubbles to tell the story.
16. Find 5 words in this book that you do not know. Write dictionary definitions for each word and then use each word in a sentence.
17. Write a letter to the author of the book telling him or her how you felt about the book. Ask at least 3 questions about the book.
18. Pretend you are going to join the main character in the story for a day. Write a journal entry about the day. Illustrate your entry.
19. Write 6 challenging math word problems using characters and events from your book. Then solve each of the problems.
20. Make a list of at least 5 ways that your book would be different if it were set 100 years in the past. Then illustrate one of them.
21. Make a T-Chart. On one side write "I Know." On the other side write "I Think." Fill in the chart with at least 5 examples on each side about the main character of your book.
22. Create a map of an important setting in the book. Include labels or a map key to show important locations from the book. Then write a caption for your map.
23. Pick an eventful or exciting part of your book. Then write a journal entry about the event as if you were the character experiencing it.
24. Make a Venn Diagram with 2 circles. Use the diagram to compare yourself to the main character in your book. Include at least 12 describing traits.
25. Write a new ending for this book. It should be at least a page long. Illustrate your ending.
26. Pretend you are going to join the main character in the story for a week. Make a list of everything you will need to pack to bring with you.
27. Create a multiple choice test for this book. Include at least 15 questions on your test.
28. Write a poem about a character or event in your book. Your poem should be at least 16 lines long.
29. Pretend you are going to write a sequel to this book. Write a paragraph that summarizes the plot of this new book. Illustrate your paragraph.
30. Make a crossword puzzle using important words from your book. Include at least 10 words. Hint: Make the puzzle on graph paper, then write the clues.

31. Pretend you are going to give a character in your story a gift - something he or she will really like. Draw a picture of the gift and write a paragraph explaining why the character will like it.
32. Make a Top Ten list of events from your book in order of importance to the story. The most important event should be #1.
33. Make a "Wanted" poster for one of the characters in your book. Tell what he/she is wanted for. This will work especially well with an evil or mean character
34. Choose 3 adjectives that describe your book. Then give examples from the book that show why you choose each adjective.
35. Write 6 questions about your book. Start each question with: who, what, where, when, why and how. Answer your questions.
36. Write a book review for your book. First summarize the book, then tell how you felt about it. You may want to include stars, thumbs up/down or some other rating system.
37. List all of the supporting characters and tell how each of them is related to the main character. Then write a sentence about each character. You may want to use 3 column chart.
38. Write a paragraph about the title of your book. Explain why you think it is a good title or a bad title. Then create a new title for the book and explain why you think it is a good title.
39. Make a list of "favorites" (such as color, sport, animal, food, etc.) for the main character of your book. Include at least 15 favorites. Use your imagination!
40. Draw pictures of at least 8 important objects from your book. Then write a sentence explaining why each object is important to the story.
41. Pretend you are going to spend the day with the main character of your book. Write a story about what you would do together.
42. Write a letter to a friend about your book. Give your friend at least 3 reasons why he or she should read the book. Include an illustration.
43. Write a true/false test for this book. Include at least 20 questions.
44. Write a summary of your book using exactly 60 words. You will probably need to write several rough drafts before you get a summary you are happy with.
45. Write a paragraph describing the main character of your book. Then draw a detailed picture of him or her.

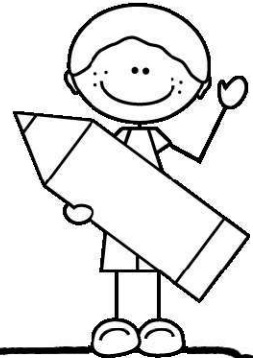
Name: _____

Date: _____

Tic-Tac-Toe Journal Prompts

(Choice Grid 1)

Use this grid to choose three journal prompts to complete. The three prompts you choose must be in a row, across, down, or diagonally. Circle your three choices.



What are your three most valuable possessions? Why are each of these things important to you?

If you could change one thing about your family, what would you change? Why?

A new student is coming to your class. What are the most important things the new student needs to know?

Finish the sentence:
I wonder...
in at least ten different ways.

If you could be an animal for a day, which animal would you choose? What would you do during your animal day?

Your parents have decided that your new bedtime should be 6:30. What can you say to convince them that this is a very bad idea?

When was a time that you felt brave? Describe what happened.

What are five of the most important jobs in the world? Why are these five jobs so important?

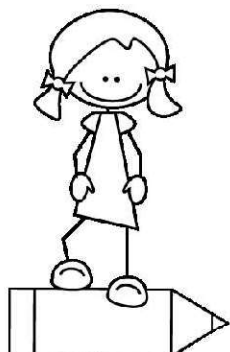
Write about how you met your best friend.

Name: _____

Date: _____

Tic-Tac-Toe Journal Prompts

(Choice Grid 2)



Use this grid to choose three journal prompts to complete. The three prompts you choose must be in a row, across, down, or diagonally. Circle your three choices.

<p>What is your favorite season? What are four things you like about that season?</p>	<p>Are you a good friend? Why or why not?</p>	<p>Would you rather be an only child or have many brothers and sisters? Why?</p>
<p>At what age is a person an adult? Why do you think so?</p>	<p>It is your birthday and you can do absolutely whatever you want. Describe your amazing birthday.</p>	<p>Pretend that you get to make up one silly rule that the whole country must follow. What rule would you create? Why?</p>
<p>In what ways are you like your parents? In what ways are you different from them?</p>	<p>The principal of your school has decided to cancel all recess for the rest of the school year. What can you say to change his or her mind?</p>	<p>You have adopted a pet dragon. What will you name him? How will you take care of him?</p>

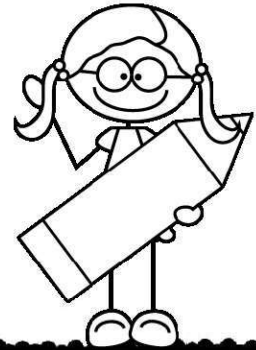
Name: _____

Date: _____

Tic-Tac-Toe Journal Prompts

(Choice Grid 3)

Use this grid to choose three journal prompts to complete. The three prompts you choose must be in a row, across, down, or diagonally. Circle your three choices.



Tell about a time when you slept in a hotel, a tent, or someone else's house.

What do you think about secrets? Write about a time when you had a secret.

Do you believe there is life on other planets? Why or why not?

Pretend you get to choose where your class will go for a fieldtrip. Where would you go? What would you learn there?

Pretend that you get to be an adult for one day. What would you do on that day?

Write about a time when you won something.

Do you think it is important to always tell the truth? Why or why not?

What is your favorite movie? What could you tell someone else to convince him or her to see that movie?

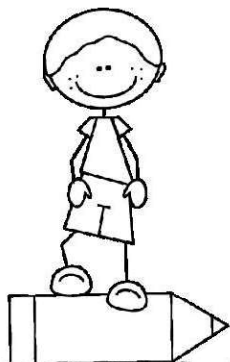
What would it mean to be a perfect person? Do you want to be perfect? Why or why not?

Name: _____

Date: _____

Tic-Tac-Toe Journal Prompts

(Choice Grid 4)



Use this grid to choose three journal prompts to complete. The three prompts you choose must be in a row, across, down, or diagonally. Circle your three choices.

Write about how you met your best friend.

Pretend that you have been given your own TV show. What will your show be called? Who will be in it? What will it be about?

Describe your favorite piece of clothing. Use as many details as you can.

When was the last time you felt really angry? What made you feel so mad? What did you do?

What was the best gift you have ever received? Why was it so special?

Imagine you have a magic box. In what way is it magical? What do you do with it?

Would you enjoy it if someone threw you a surprise party? Why or why not?

Would you rather be very smart or very good looking? Why?

Pretend that you can become invisible whenever you want. What are some things you would do?

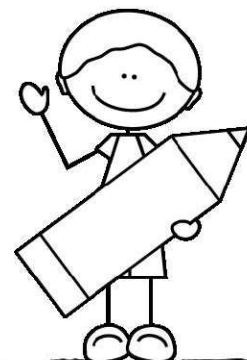
Name: _____

Date: _____

Tic-Tac-Toe Journal Prompts

(Choice Grid 5)

Use this grid to choose three journal prompts to complete. The three prompts you choose must be in a row, across, down, or diagonally. Circle your three choices.



Pretend that you get to make one law that everyone in the world must follow. What law would you make? Why?

What are some things that teachers should never do?

If you were a wild animal, would you rather live in the zoo or in nature? Why?

In what ways is your life different from your grandparent's lives? In what ways is it the same?

Describe your dream vacation.

Do you think that children should have to keep their rooms clean? Why or why not?

An alien offered to let you visit her planet for a week. Write about what you did and saw on your visit.

What are the most important things about you that other people should know? Why are each of these things important?

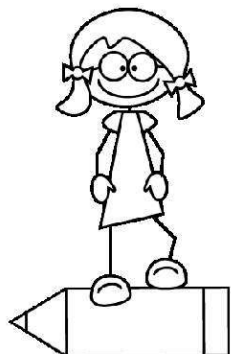
Pretend you could control the weather. What would you do?

Name: _____

Date: _____

Tic-Tac-Toe Journal Prompts

(Choice Grid 6)



Use this grid to choose three journal prompts to complete. The three prompts you choose must be in a row, across, down, or diagonally. Circle your three choices.

Pretend that you get to invent a new holiday. What will your holiday be called. What will people do to celebrate your holiday?

What does it mean to forgive someone? Write about a time when you forgave someone or a time when you were forgiven.

Write about a joke you would like to play on someone.

What do you think would happen if other people could read your thoughts?

If animals could talk, what animal would you most want to have a conversation with? What would you talk about?

Describe the worst babysitter you can imagine.

When was a time when you felt really happy? What made you feel so happy?

What are your three most valuable possessions? Why are each of these things important to you?

What superpower would you most like to have? What would you do if you had this superpower?

The Geographer's World

Lesson 1: How Geographers View the World

ESSENTIAL QUESTION

How does geography influence the way people live?

Terms to Know

geography the study of Earth and its people, places, and environments

spatial Earth's features in terms of their places, shapes, and relationships to one another

landscape the portions of Earth's surface that can be viewed at one time from another location

relative location the location of one place compared to another place

absolute location the exact location of something

latitude the lines on a map that run east to west

Equator a line of latitude that runs around the middle of Earth

longitude the lines on a map that run north to south

Prime Meridian the starting point for measuring longitude

region a group of places that are close to one another and share some characteristics

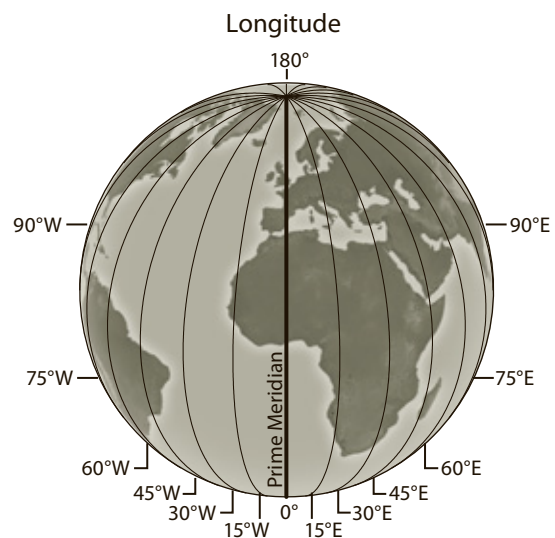
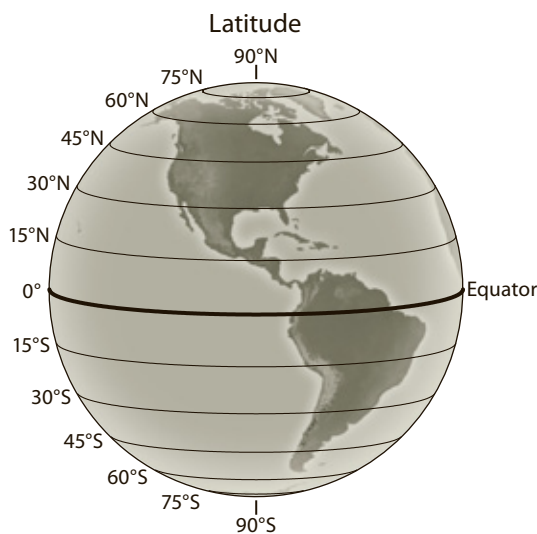
environment the natural surroundings of a place

landform the shape and nature of the land

climate the average weather in an area over a long period of time

resource a material that can be used to produce crops or other products

Where in the world?



The Geographer's World

Lesson 1: How Geographers View the World, *Continued*



Marking the Text

1. Read the text on the right. Highlight the different ways it means to think spatially.



Defining

2. Give three additional examples of landscapes.



Making Connections

3. Describe how you experience geography in your daily life.



Reading Progress Check

4. How is geography related to history?

Geographers Think Spatially

Guiding Question *What does it mean to think like a geographer?*

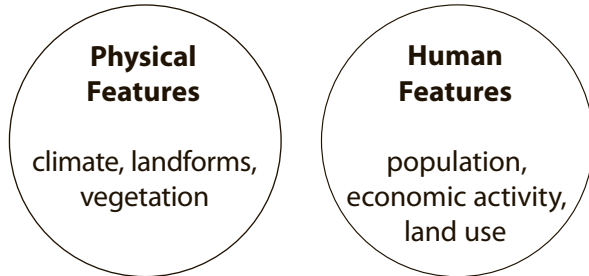
Geographers try to understand the world. They look at people and the world in which they live. Geographers study why people live where they do. They also study how people relate to each other and to their environment. **Geography** is the study of Earth and its people, places, and environments.

One way geographers look at Earth is spatially. **Spatial** means “taking up space.” Therefore, they study the things that take up space on Earth, including cities, countries, mountains, and lakes.

Thinking spatially means that you consider:

- where things are located on a map,
- their size and direction,
- how far apart they are,
- how different places are related to each other,
- and what characteristics they have.

Earth is filled with both physical and human features.



One way to learn about places is to study **landscapes**. If you look out at the street from your front porch, you are looking at a landscape. Geographers use landscapes to learn more about the physical and human features they see.

Geography isn't just something we look at, though. It is something we experience. We see it in the change of seasons, we hear it in the sound of birds, we feel it when we walk on sidewalks, and we learn about it when we watch TV. This is all geography.

In addition, Earth is always changing. Rivers shift course, volcanoes erupt, cities grow larger, and nations expand. Geographers study how places change over time. As they study, they ask many questions. What impact did those changes have? What factors made a city grow? What effect did its growth have on the people who lived there?

The Geographer's World

Lesson 1: How Geographers View the World, *Continued*

The Five Themes of Geography

Guiding Question *How can you make sense of a subject as large as Earth and its people?*

Geographers like to organize information about the world into five themes: location, place, region, human interaction with the environment, and movement.

The first theme is location. Location is where something is found on Earth. There are two types of location: relative and absolute. **Relative location** describes where a place is compared to another place. For example, knowing that New Orleans is near the mouth of the Mississippi River helps us understand why the city became an important trading port.

Absolute location is the *exact* location of something. Maps show absolute location with horizontal and vertical lines. Horizontal lines are called lines of **latitude**. They run east to west and measure distance going north to south. The **Equator** is a line of latitude in the middle of Earth and has latitude of 0°.

Vertical lines are called lines of **longitude**. They run north to south and measure distance going east to west. The **Prime Meridian** is the starting point for measuring longitude. It has a longitude of 0°.

Place and region are additional themes. When places are close to one another, they share some features, which means they belong to the same **region**. Both places and regions can be described by human and physical features. Geographers like to study regions so they can look for patterns in larger areas. They also want to examine special features that make each place in a region unique.

The fourth theme is how humans interact with their environment. The **environment** is the natural surroundings of a place. It includes landforms, climate, and resources. **Landforms** are the shape and nature of the land. Hills, valleys, and mountains are all types of landforms. **Climate** is the average weather in a place over a long period of time. **Resources** are the materials that come from a place. They are used to plant crops or make other products.

The final theme is movement. People might have to move for many reasons, such as war, famine, or religious freedom. When a lot of people move, there might be problems with not enough housing or jobs. Products also move from place to place. Roads, ships, airplanes and trucks are important to movement. Ideas can move over the Internet, telephone, television, and radio.

? Locating

5. Describe the difference between relative and absolute location.

✓ Reading Progress Check

6. How is the theme of location related to the theme of place?

? Summarizing

7. Summarize how people, products, ideas, and information move from place to place.

The Geographer's World

Lesson 1: How Geographers View the World, *Continued*



Reading Progress Check

8. How do geographers use visuals?



Drawing Conclusions

9. Why is it important for geographers to ask *why* and *how* questions?

Skill Building

Guiding Question *How will studying geography help you develop skills for everyday life?*

Geographers use maps and many other visuals to show a representation of the world. Visuals include graphs, charts, diagrams, and photographs. By studying geography, you can learn to use these visuals, too.

Visual	Use
Graphs	Help compare information
Charts	Show information in columns and rows
Diagrams	Use pictures to show something in the world

Geographers also ask analytical questions about the world. They may want to examine causes and effects. Or they may want to analyze how something changed over time. For instance, they may ask: How does climate affect how people live? Or they may ask: Why do people in different nations use resources differently?

As you study geography, you can learn to ask—and answer—questions like these, too.

Writing

Check for Understanding

1. Narrative Describe your neighborhood spatially. Include its location, shape, characteristics, and the relationship between human and physical features.

2. Informative/Explanatory Give an example of how humans can affect the environment and how the environment can affect humans.

Physical Geography

Lesson 3: Land and Water

ESSENTIAL QUESTION

How does geography influence the way people live?

Terms to Know

plateau a flat area that rises above the surrounding land

plain a large expanse of land that can be flat or have a gentle roll

isthmus a narrow strip of land that connects two larger land areas

continental shelf the part of a continent that extends into the ocean, then drops off sharply

trench a long, narrow, steep-sided cut on the ocean floor

desalination a process that makes salt water safe to drink

groundwater the water contained inside Earth's crust

delta an area where sand, silt, clay, or gravel is dropped at the mouth of a river

water cycle the process in which water is used and reused on Earth

evaporation the change of liquid water to water vapor

condensation the change of water vapor to a liquid or solid state

acid rain rain that contains harmful amounts of poisons due to pollution

What Do You Know?

In the first column, answer the questions based on what you know before you study the lesson. After this lesson, complete the last column.

Now...		Later...
	Where is water vapor found on Earth?	
	Where is liquid water found on Earth?	
	Where is solid water found on Earth?	

Physical Geography

Lesson 3: Land and Water, *Continued*

Land Takes Different Forms

Guiding Question *What kinds of landforms cover Earth's surface?*

Earth has many different landforms. Scientists group landforms by characteristics. One characteristic they use is elevation. Elevation describes how far above sea level a landform is.

A **plateau** is a flat area that rises above the surrounding land. A **plain** is a large expanse of land that can be flat or have a gentle roll. A valley is a lowland area between two higher sides. Some valleys are small, while others are very large. Because water runs into them, valleys often have rich soil that is good for farming and raising livestock.

Landforms can also be described by their relation to water. Some landforms are surrounded by water. Continents are huge landmasses surrounded mostly by water. Islands are much smaller landmasses completely surrounded by water.

A peninsula is a long, narrow landform that extends into water. A peninsula is always connected to a larger landmass at one end. An **isthmus** is a narrow strip of land that connects two larger land areas. The Central American country of Panama is on an isthmus located at the narrowest point in the Americas.

The ocean floor also has different landforms. One type of ocean landform is the continental shelf. A **continental shelf** is an underwater plain that borders the edge of a continent. A continental shelf ends when it slopes downward to the ocean floor. Another type of ocean landform is a trench. A **trench** is a long, narrow, steep-sided cut on the ocean floor. The ocean floor also has mountains and volcanoes.

The Blue Planet

Guiding Question *What types of water are found on Earth's surface?*

Water can exist in different forms: solid, liquid, and gas. All three forms can be found all over the world.

Forms of Water	
solid	glaciers, polar ice caps, and ice sheets
liquid	rivers, lakes, and oceans
gas	water vapor in the atmosphere

Activating Prior Knowledge

1. On what type of landform do you live?

Marking the Text

2. Circle two types of landforms found on continents. Underline two types of landforms found on the ocean floor.

Activating Prior Knowledge

3. How is an island similar to a lake?

Reading Progress Check

4. How is a valley similar to an ocean trench?

Physical Geography

Lesson 3: Land and Water, *Continued*

? Identifying

5. What is the body of salt water closest to where you live? What is the body of freshwater closest to you?

✎ Inferring

6. Why is desalination an important process?

? Explaining

7. How is a delta formed?

✓ Reading Progress Check

8. Describe three ways in which water affects your life.

Water at Earth’s surface can either be freshwater or salt water. Salt water contains salt and other minerals. Most of Earth’s water is salt water. Salt water makes up all of Earth’s oceans and a few lakes and seas. Even though many plants and animals live in salt water, humans cannot drink salt water. **Desalination** is a process that separates out most salt and minerals and makes salt water safe to drink.

Freshwater makes up only three percent of the water on Earth. Most freshwater is frozen in the Arctic and Antarctic. Liquid freshwater is found in lakes, rivers, ponds, swamps, and in the ground. Water contained inside Earth’s crust is called **groundwater**. Groundwater is an important source of drinking water.

Earth’s largest bodies of water are its four salt water oceans. From largest to smallest they are the Pacific, Atlantic, Indian, and Arctic. The oceans are all connected to one another.

The places where oceans meet landmasses have unique land features. A coastal area where ocean waters are partially surrounded by land is called a bay. Larger areas that are partially surrounded by land are called gulfs.

Freshwater rivers are found all around the world. Some rivers meet other rivers and join to make a larger river. A river’s end point is called the mouth of the river. A **delta** is an area where sand, silt, clay, or gravel is dropped at the mouth of a river.

Bodies of water affect the people who live near them. People can fish for food. The ocean floor can be mined for minerals. Water is used for transportation, and also for sports and recreation.

The Water Cycle

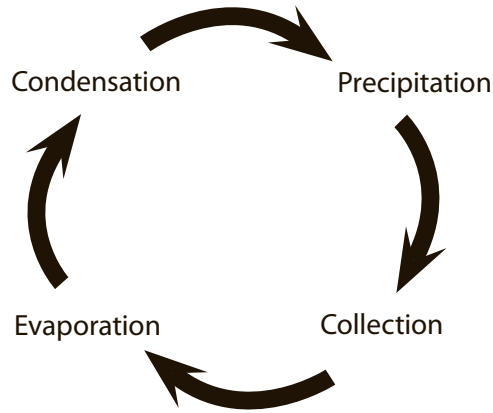
Guiding Question *What is the water cycle?*

The amount of water on Earth has not changed since the planet was formed billions of years ago. Water is constantly recycled. It moves over, under, and above Earth’s surface and changes form as it is recycled. This system is called the **water cycle**.

As the sun warms water on Earth, the liquid water changes into water vapor. This is called **evaporation**. Evaporation happens constantly around us. As water evaporates, tiny droplets of air rise into the atmosphere and gather into clouds. Eventually, the water vapor changes into the liquid or solid state. This is called **condensation**. Water then falls back to the Earth’s surface as rain, snow, or hail. Liquid rainwater collects in rivers, lakes, oceans, and underground water supplies. In this way, water taken from Earth’s surface during evaporation returns as precipitation.

Physical Geography

Lesson 3: Land and Water, *Continued*



Human actions have damaged the world’s water supply. Toxic chemicals have polluted rivers, lakes, oceans, and groundwater. Some of the fuels we use to create energy release poisonous gases into the air. These gases combine with water vapor, which then falls to Earth as **acid rain**. Acid rain pollutes drinking water, erodes mountains and buildings, and kills plants and animals in lakes, rivers, and oceans.

 **Marking the Text**

9. Circle the process by which water enters the atmosphere. Underline the process by which water vapor returns to Earth.

 **Reading Progress Check**

10. What are the causes and effects of acid rain?

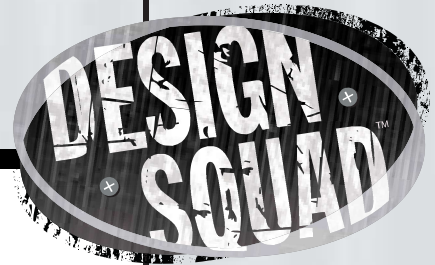
Writing

Check for Understanding

1. Narrative Write a paragraph about the life of a child who lives on the coastline. Be sure to include details about how living near water affects the child’s life.

2. Informative/Explanatory If the amount of water on Earth has not changed, why should humans be worried about the world’s water supplies?

WATERCRAFT



YOUR CHALLENGE

Design and build a boat out of straws and plastic wrap that can hold 25 pennies for at least ten seconds before sinking.

BRAINSTORM & DESIGN

Look at your materials and think about the questions below. Then sketch your ideas on a piece of paper or in your design notebook.

1. How will you make a boat that floats well enough to support a heavy load without sinking?
2. Should your boat be a platform (e.g., a raft or barge) or an open boat (e.g., a rowboat or canoe)?
3. What's the best way to make your boat waterproof?
4. How big do you need to make your boat to hold 25 pennies?

BUILD, TEST, EVALUATE & REDESIGN

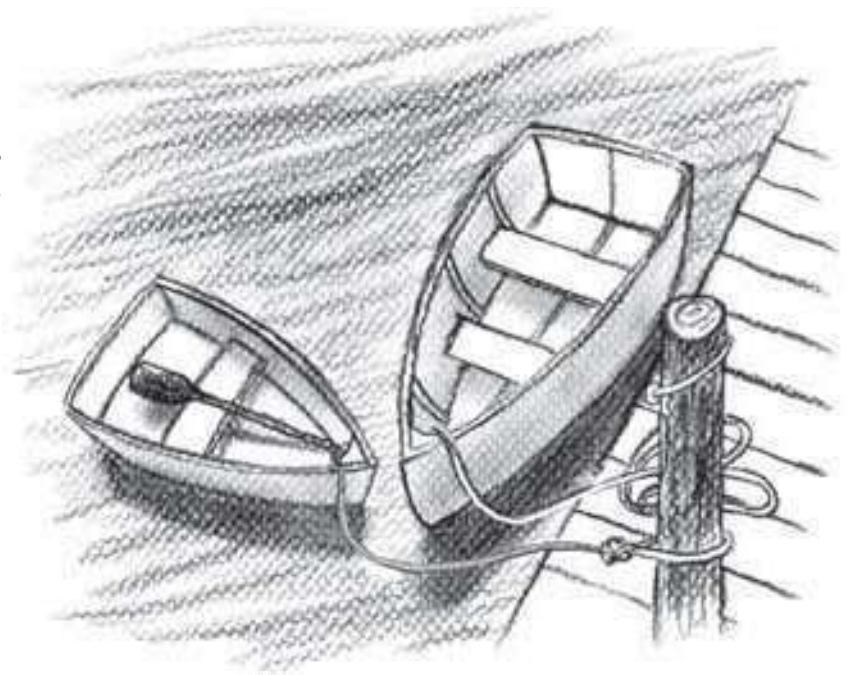
Use the materials to build your boat. Then test it by floating it in a container of water and adding pennies, one at a time. When you test, your design may not work as planned. When engineers solve a problem, they try different ideas, learn from mistakes, and try again. The steps they use to arrive at a solution is called the **design process**. Study the problems and then redesign. For example, if the boat:

- sinks easily—*Increase its ability to float. When you set your boat in water, notice how it sinks down a bit, pushing aside some water. The water pushes right back, pressing on the boat's bottom and sides. The force from these pushes is called **buoyancy**. To change your boat's buoyancy, experiment with the boat's width and the height of its sides.*
- leaks a lot—*See if the straws are filling with water or if the plastic wrap is separating.*
- tips easily—*Check how near the weights are to each other. A boat can get tippy when one part is heavier than another.*

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MATERIALS (per person)

- container filled with water (e.g., bucket, sink, plastic tub)
- duct tape
- paper cups (8-ounce or larger)
- 10-inch strip of plastic wrap
- 10 straws
- towels (paper or cloth)
- 25 pennies (or 15 standard, flat steel washers, at least 1 inch in diameter)



TAKE IT TO THE NEXT LEVEL

- Ready for some heavy lifting? Change your boat so it holds 50 pennies for at least ten seconds before sinking.
- Less is more! Build another boat that can hold 25 pennies, but use only half the amount of materials that you used for your first boat.

MAKE IT ONLINE

Underwater boat?

Build a self-propelled submarine out of 2 soda bottles, a rubber band, and 2 paper clips. See how on Make Magazine's project page at makezine.com/designsquad.

ENGINEERING IN ACTION



Windsurf across an ocean? In 2006, Raphaëla le Gouvello windsurfed 3,541 miles across the Indian Ocean—a record-setting first! Raphaëla first discovered windsurfing while on a family vacation. Soon, the idea of windsurfing across an entire ocean caught her imagination. To turn her dream into reality, she teamed up with engineer Guy Saillard. His challenge was to make her a sailboard she could live on. For years, Guy had experimented with new ways to use durable hi-tech materials such as epoxy resin, carbon fiber, and foams. For Raphaëla, he designed a strong, lightweight, 25-foot-long sailboard. It has a sleeping compartment, a shower, and its own satellite communication system—all the comforts of home. Or not! The cabin was only 8 feet long, 20 inches wide, and 31 inches high (slightly bigger than a coffin). If an engineer could build you the boat of your dreams, would you want to take a trip like Raphaëla's? Here's a snapshot:

- **Length of trip:** Two months.
- **Time sailed each day:** Seven hours.
- **Time spent sleeping:** Seven hours.
- **Weight of her first-aid kit:** 26 pounds.
- **Other things she did each day:** Send e-mail, check her course, get weather reports, talk to her support team by radio, relax, and make and eat meals.
- **Amount of water she used per shower:** A half gallon. The average shower in the US uses 18 gallons! Her boat only holds five gallons, but it has a solar-powered device that makes fresh water by taking the salt out of seawater.



Watch the **DESIGN SQUAD PVC Kayak** episode on PBS or online at pbs.org/designsquad.



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PAPER TABLE

CHALLENGE 2

LEADER NOTES

The Challenge

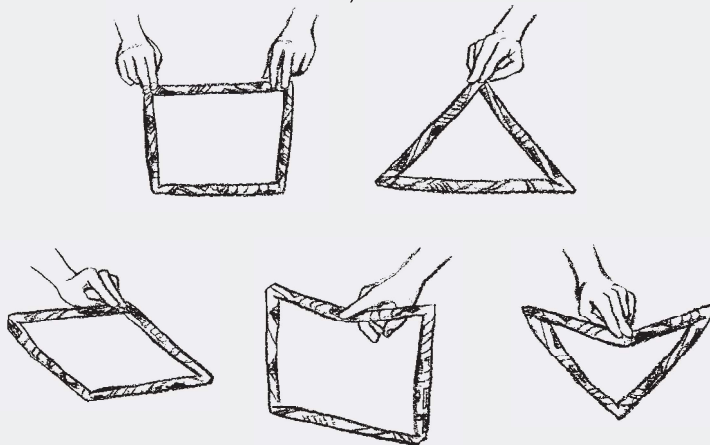
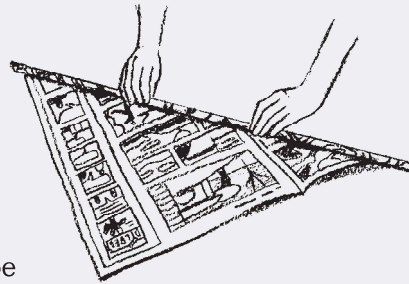
Use tubes of newspaper to make a table that's at least eight inches tall and strong enough to hold a heavy book.

In this challenge, kids (1) follow the design process to build a sturdy table out of paper tubes; (2) make paper support more weight by changing its shape; and (3) figure out ways to keep the table legs from buckling.

1 Introduce the challenge (5 minutes)

Begin by telling kids the challenge. Then get them thinking about ways to get paper to support a lot of weight. Ask:

- How can you make a piece of paper support a lot of weight? (You can fold, roll, layer, or reinforce it. In this activity, kids use sheets of newspaper rolled into tubes. To make a strong tube, roll it tight. Demonstrate how to do this. Start at one corner and roll diagonally toward the other corner. Your first roll should be about the diameter of a straw. Tape the tube closed with a strip or two of tape. Wave it around to show how stiff it is.)
- Tables and chairs have supports to keep their legs from tilting or twisting. Look at the furniture in this room. How would you describe the supports you see? (Table legs often use rods for support. The rods often form a triangle with the leg. Take two newspaper tubes. Bend one into a triangle and the other into a square. Tape them closed and set them on the floor. Push down on them and rock them side to side. The triangle will withstand more force and be more stable than the square. However, orientation matters. If you turn it so it rests on a point, the triangle will be weaker and less stable than before.)



2 Brainstorm and design (10 minutes)

Show kids the materials and ask, "How can you use these materials to make a paper table that's at least eight inches tall and strong enough to hold a book?" After discussing their ideas, have them sketch their designs on a piece of paper or in their design notebooks.



SHOW KIDS THE RELATED TV EPISODE



Photo: Anthony Tieuli

In Paper Table, kids figure out ways to use paper to make strong tables. Show them the Cardboard Furniture episode in which *Design Squad* teams compete to build cardboard furniture that is modern, comfortable, innovative, and functional. Get it online at pbs.org/designsquad.



Photo: Renée Mattler

It takes much more force to crumple paper when it's rolled into a tube than when it's in a flat sheet.



Photo: Ellen Robinson

In general, the more triangles kids use in their tables, the stronger and more stable they will be.



Photo: Renée Mattier

Changing the shape of a material affects its strength. Any shape that distributes the force of a load increases a material's strength.

3 Build, test, evaluate, and redesign (35 minutes)

Distribute the challenge sheet and have kids begin building. If any of the following issues come up, ask kids questions to get them thinking about how they might solve their problems.

- The table legs tilt or twist. *Support the legs by running tubes between them.*
- A tube buckles when weight is applied. *See if the tube is loosely rolled. If so, re-roll it tighter and tape it securely closed. Also, dents and creases weaken a tube. Add a support or reinforce the weak area or replace the damaged tube with a new one.*
- The table wobbles. *Make sure that the table isn't lopsided, that there are adequate supports, and that the tubes are undamaged. Also, a table becomes tippier as its height increases. If a table is very tall and reinforcing the legs doesn't work, suggest reducing its height.*
- The table collapses. *Check that the base of the table is truly sturdy. Remind kids that engineers often put materials together in triangular arrangements to increase their strength and stability. In general, the more triangles kids use to build their table, the stronger it will be.*

4 Discuss what happened (10 minutes)

Have kids talk about their designs and how they solved any problems that came up. Emphasize the key themes in this challenge—making paper support more weight by changing its shape, and designing a stable, strong table base—by asking questions such as:

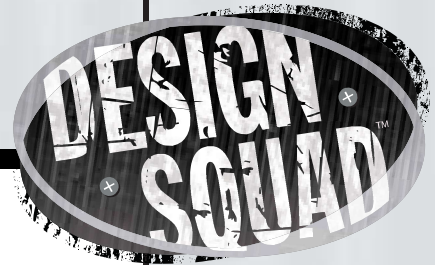
- How were you able to support a heavy book on just pieces of newspaper? *(Kids changed the paper's shape. A tubular shape distributes a load well and increases the amount of weight the paper can support. With a tube, the book's weight pushes on every part of the paper, not just one section of it. A tubular shape also resists buckling.)*
- How did knowing that certain arrangements of materials (like triangles) are stronger than others influence the design of your table? *(Answers will vary.)*
- What helped your table be especially strong? *(Kids may mention the use of good bracing, sturdy frames, triangles, and keeping the table as compact as possible.)*

FOR EVENTS

- Draw kids into your area by asking, "Do you think you can build a table out of newspaper?"
- To avoid spending time teaching each person how to make a tube out of newspaper, make samples that illustrate the process described in the Introduce the Challenge section. For example, take three pieces of newspaper. With the first, show how tight the first roll needs to be. With the second, show the paper rolled halfway up. With the third, show a finished tube. Tape these samples to a piece of poster board and label them accordingly.

To determine how many materials you'll need for different-sized events, for information on obtaining large quantities of materials, and for other general event tips, see page 7.

PAPER TABLE



YOUR CHALLENGE

Design and build a table out of newspaper tubes. Make it at least eight inches tall and strong enough to hold a heavy book.

BRAINSTORM & DESIGN

Look at your materials and think about the questions below. Then sketch your ideas on a piece of paper or in your design notebook.

1. How can you make a strong tube out of a piece of newspaper? (This challenge uses tubes because it takes more force to crumple paper when it's shaped as a tube.)
2. How can you arrange the tubes to make a strong, stable table?
3. How can you support the table legs to keep them from tilting or twisting?
4. How level and big does the table's top need to be to support a heavy book?



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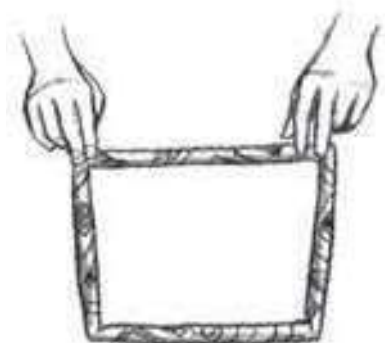
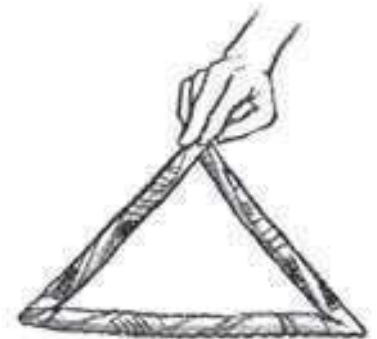
MATERIALS (per person)

- 1 piece of cardboard or chipboard (approximately 8 ½ x 11 inches)
- heavy book (e.g., a textbook or telephone book)
- masking tape
- 8 sheets of newspaper

BUILD, TEST, EVALUATE & REDESIGN

Use the materials to build your table. Then test it by carefully setting a heavy book on it. When you test, your design may not work as planned. If things don't work out, it's an opportunity—not a mistake! When engineers solve a problem, they try different ideas, learn from mistakes, and try again. Study the problems and then redesign. For example, if:

- the tubes start to unroll—*Re-roll them so they are tighter. A tube shape lets the load (i.e., the book) push on every part of the paper, not just one section of it. Whether they're building tables, buildings, or bridges, **load distribution** is a feature engineers think carefully about.*
- the legs tilt or twist—*Find a way to stabilize and support them. Also check if the table is lopsided, too high, or has legs that are damaged or not well braced.*
- a tube buckles when you add weight—*Support or reinforce the weak area, use a wider or thicker-walled tube, or replace the tube if it's badly damaged. Changing the shape of a material affects its strength. Shapes that spread a load well are strong. Dents, creases, and wrinkles that put stress on some areas more than others make a material weaker.*
- the table collapses—*Make its base as sturdy as possible. Also, a table with a lot of triangular supports tends to be quite strong. A **truss** is a large, strong support beam. It is built from short boards or metal rods that are arranged as a series of triangles. Engineers often use trusses in bridges, buildings, and towers.*



TAKE IT TO THE NEXT LEVEL

- If a little is good, a lot is better! Build a table that can hold two or more heavy books.
- The sky's the limit. Build a table that can hold a heavy book 16 inches above the ground.
- Matching furniture! Build a chair out of newspaper.

MAKE IT ONLINE

Paper guitar?

Build a great-sounding guitar out of a box, string, wood, and wire. See how on Make Magazine's project page at makezine.com/designsquad.

ENGINEERING IN ACTION

A paper house? Better leave your matches outside! Check out these items that engineers made out of paper. Then choose from the list and see if you can figure out the year each item was invented.

Years these items were invented: 1922; 1931; 1967; 1995; 2004; 2007

A. Paper Church

After a big earthquake in Japan, engineers quickly made a building by stretching a paper "skin" across 58 paper tubes, each over 16 feet long. The church was only meant to be a temporary place of worship. But it's still standing today.

B. Paper Video Disc

This disc holds more than three times as much data as a standard DVD and is much better for the environment. But you'll have to stay tuned—there's no release date set.

C. Paper House

An engineer built a vacation home out of newspaper. He glued newspapers into one-inch-thick slabs and then used them to make the walls. It's still standing!

D. Paper Towels

By mistake, a factory made rolls of paper that were too thick for toilet paper but too weak for most other uses. But where others see problems, engineers see possibilities. The paper was sold as "Sani-Towels," which soon became known as paper towels.

E. Paper Batteries

They're smaller than a postage stamp but can power a light bulb! And they decompose in landfills. Engineers are still figuring out how to get them to work with all our gadgets.

F. Paper Dresses

Engineers created paper outfits that could be printed with designs. They were sold in boutiques and in stationery stores, where you could get a tablecloth to match!

(Answers: A: 1995; B: 2004; C: 1922; D: 1931; E: 2007; F: 1967)



Watch the **DESIGN SQUAD** Cardboard Furniture episode on PBS or online at pbs.org/designsquad.



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