

<p align="center"><b>Pre-Kindergarten</b></p> <p align="center"><b>WORKING WITH DATA: PROBABILITY AND STATISTICS</b></p> <p align="center">Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.</p>		
<p align="center"><b>How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?</b></p>		
Students should...	Performance Standards	Expected Performances
<p>4.1 <b>Collect data</b> and <b>Organize data</b> and <b>Display data</b> using appropriate</p> <ul style="list-style-type: none"> <li>• statistical methods &amp;</li> <li>• graphical methods.</li> </ul>	<p>a. Make comparisons from information displayed in real graphs.</p>	<p><b>(1) Collect</b> and <b>Describe</b> and <b>Organize</b> and <b>Sort</b> and <b>Display</b></p> <ul style="list-style-type: none"> <li>• objects in real graphs and</li> <li>• pictures in real graphs.</li> </ul>
<p>4.3 <b>Understand</b> and <b>Apply</b> basic concepts of probability.</p>	<p>a. Determine when events are likely to happen again.</p>	<p><b>(1)</b> Use patterns to describe some events that repeat.</p> <p><b>(2)</b> Identify events related to personal experiences as</p> <ul style="list-style-type: none"> <li>• likely to happen OR</li> <li>• unlikely to happen.</li> </ul>

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Students should...	Performance Standards	Expected Performances
<p>4.1 <b>Collect data</b> and <b>Organize data</b> and <b>Display data</b> using appropriate</p> <ul style="list-style-type: none"> <li>• statistical methods &amp;</li> <li>• graphical methods.</li> </ul>	<p>a. <b>Visualize information</b> and <b>Make comparisons</b> about information displayed in</p> <ul style="list-style-type: none"> <li>• real graphs and</li> <li>• picture graphs.</li> </ul>	<p>(1) Pose questions about <b>personal information</b> and <b>experiences</b> and <b>environment</b>.</p> <p>(2) Explore ways to <b>record data</b> and <b>organize data</b></p> <ul style="list-style-type: none"> <li>• using tallies and</li> <li>• using tables.</li> </ul> <p>(3) <b>Construct real graphs</b> and <b>Construct picture graphs</b> and</p> <p>Describe the data using the terms</p> <ul style="list-style-type: none"> <li>• more,</li> <li>• less and</li> <li>• same.</li> </ul> <p>(4) Organize information through</p> <ul style="list-style-type: none"> <li>• systematic counting,</li> <li>• sorting,</li> <li>• making lists and</li> <li>• making graphic organizers.</li> </ul>
<p>4.2 Analyze data sets to</p> <ul style="list-style-type: none"> <li>• form hypotheses and</li> <li>• make predictions</li> </ul> <p>[<i>data set: collection of data</i>]</p>	<p>a. Extend different types of patterns and</p> <p>Make predictions.</p>	<p>(1). Identify</p> <ul style="list-style-type: none"> <li>• visual patterns</li> <li>• auditory patterns &amp;</li> <li>• physical patterns and</li> </ul> <p>Extend [<i>the patterns?</i>] to make predictions.</p>
<p>4.3 <b>Understand</b> and <b>Apply</b> basic concepts of probability.</p>	<p>a. Observe the frequency of real-world events and</p> <p>Identify the likelihood of future events.</p>	<p>(1) Describe the likelihood of events related to personal experiences.</p> <p>(2) Engage in simple probability activities and</p> <p>Discuss the results of the probability activities.</p>

<b>Grade One</b> <b>WORKING WITH DATA: PROBABILITY AND STATISTICS</b> Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.		
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Students should...	Performance Standards	Expected Performances
<p>4.1 <b>Collect data</b> and <b>Organize data</b> and <b>Display data</b> using appropriate</p> <ul style="list-style-type: none"> <li>• statistical methods &amp;</li> <li>• graphical methods.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">Legend [GLYPH]</p> <p>Square Body = prefers science                      Rectangular Body = prefers math                      Circular Body = prefers reading                      Squiggly antennae = is 9 years or older                      Straight antennae = is between 8 and 9                      Zig Zag Antennae = is younger than 8</p> </div>	<p>a. Collect data.                      Organize data.                      Record data.                      Describe data.</p> <div style="text-align: center; margin-top: 10px;"> </div>	<p>(1) Pose questions.  <b>Collect data</b> and <b>Organize data</b> and <b>Record data</b> and <b>Describe data</b> using</p> <ul style="list-style-type: none"> <li>• tallies</li> <li>• tables</li> <li>• real graphs</li> <li>• picture graphs</li> <li>• glyphs (coded pictures)</li> <li>• bar graphs</li> </ul>
<p>4.2 Analyze data sets to</p> <ul style="list-style-type: none"> <li>• form hypotheses and</li> <li>• make predictions</li> </ul> <p>[<i>data set: collection of data</i>]</p>	<p>b. Organize data</p> <ul style="list-style-type: none"> <li>• in tables</li> <li>• in graphs</li> </ul> <p>Make comparisons of the data.</p>	<p>(1) Use various methods to organize information including</p> <ul style="list-style-type: none"> <li>• lists</li> <li>• systematic counting</li> <li>• sorting</li> <li>• graphic organizers</li> <li>• tables</li> </ul> <p>(2) Use comparative language to describe the data</p> <ul style="list-style-type: none"> <li>• in tables</li> <li>• in graphs</li> </ul>
<p>4.3 <b>Understand</b> and <b>Apply</b> basic concepts of probability.</p>	<p>a. Determine the likelihood of certain events through</p> <ul style="list-style-type: none"> <li>• simple probability experiments</li> <li>• observation of probability games</li> </ul>	<p>(1) <b>Observe</b> and <b>Record</b> and <b>Graph</b> and <b>Describe</b> the results of</p> <ul style="list-style-type: none"> <li>• simple probability activities and</li> <li>• probability games</li> </ul> <p>(2) <b>Describe</b> and <b>Explain</b> the likelihood of various events in the students' world.</p>

<p align="center"><b>Grade Two</b>  <b>WORKING WITH DATA: PROBABILITY AND STATISTICS</b>                      Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.</p>		
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Students should...	Performance Standards	Expected Performances
<p>4.1 <b>Collect data</b> and <b>Organize data</b> and <b>Display data</b> using appropriate</p> <ul style="list-style-type: none"> <li>• statistical methods &amp;</li> <li>• graphical methods.</li> </ul>	<p>a. Construct graphs from data</p> <p>then make comparisons</p> <p>and draw conclusions</p>	<p><b>(1)</b> Pose questions and</p> <p>Systematically <b>collect data</b> and Systematically <b>sort data</b> and Systematically <b>organize data</b> and Systematically <b>record data</b> and Systematically <b>analyze data</b> using</p> <ul style="list-style-type: none"> <li>• tables</li> <li>• charts</li> <li>• picture graphs</li> <li>• bar graphs</li> </ul> <p><b>(2)</b> Use comparative terms to describe data.</p>
<p>4.2 Analyze data sets to</p> <ul style="list-style-type: none"> <li>• form hypotheses and</li> <li>• make predictions</li> </ul> <p>[<i>data set: collection of data</i>]</p>	<p>a. Determine patterns displayed in</p> <ul style="list-style-type: none"> <li>• tables</li> <li>• graphs</li> </ul> <p>Make predictions from data displayed in</p> <ul style="list-style-type: none"> <li>• tables</li> <li>• graphs</li> </ul>	<p><b>(1)</b> Investigate combinations using models.</p> <p>[<i>Example: Joe wants to make an ice cream sundae. He has 2 flavors of ice cream – vanilla and chocolate. He has 2 types of sauce – fudge and peanut butter. He may use only one flavor of ice cream with one sauce. How many different sundaes can he make? Show all the different sundaes he can make.</i>]</p>

**Grade Two Continued on Next Page**

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Students should...	Performance Standards	Expected Performances
<p>4.3 <b>Understand</b> and <b>Apply</b> basic concepts of probability.</p>	<p>a. Analyze data gathered from experiments and</p> <p>Identify the likelihood of future events.</p>	<p><b>(1)</b></p> <ul style="list-style-type: none"> <li>- Discuss the likelihood of various events,</li> <li>- State possibilities</li> <li>- Made predictions AND</li> <li>- Test them [<i>the predictions?</i>] in practical situations</li> </ul> <p><b>(2)</b> Conduct probability experiments</p> <p>And then record the results in</p> <ul style="list-style-type: none"> <li>• tables and</li> <li>• graphs</li> </ul>

<b>Grade Three</b> <b>WORKING WITH DATA: PROBABILITY AND STATISTICS</b> Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.		
<b>How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?</b>		
Students should...	Performance Standards	Expected Performances
<p>4.1 <b>Collect data</b> and <b>Organize data</b> and <b>Display data</b> using appropriate</p> <ul style="list-style-type: none"> <li>• statistical methods &amp;</li> <li>• graphical methods.</li> </ul> <p>Line Plot: A graph that shows the <u>frequency of data</u> along a <u>number line</u>.  <b>Example:</b></p> <p style="font-size: small;">Cookies Eaten at a Party</p>	<p>a. Design surveys for the collection of data and Justify conclusions drawn from the data.</p>	<p>(1) Pose questions and Use a variety of ways to <b>collect data</b> and <b>organize data</b> and <b>analyze data</b></p> <ul style="list-style-type: none"> <li>• from samples</li> <li>• from surveys</li> </ul> <p>(2) <b>Display</b> and <b>Read</b> and <b>Interpret</b> and <b>Draw conclusions from</b> data that is represented in a variety of ways including</p> <ul style="list-style-type: none"> <li>• tables</li> <li>• charts</li> <li>• lists</li> <li>• diagrams</li> <li>• line plots</li> <li>• graphs</li> </ul>
<p>4.2 Analyze data sets to</p> <ul style="list-style-type: none"> <li>• form hypotheses and</li> <li>• make predictions</li> </ul> <p>[<i>data set: collection of data</i>]</p>	<p>a. Analyze data to identify a typical</p> <ul style="list-style-type: none"> <li>• element</li> <li>• event</li> </ul>	<p>(1) Describe trends in data using <b>range</b> and <b>mode</b></p>
<p>4.3 <b>Understand</b> and <b>Apply</b> basic concepts of probability.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Range:</b> The difference between the greatest and the least value in a set of data</p> <p><b>Mode:</b> The number that appears most frequently in a set of numbers. There may be one, more than one, or no mode.</p> </div>	<p>a. <b>Use samples</b> and <b>Use situations</b></p> <ul style="list-style-type: none"> <li>• to determine probability</li> <li>• to make predictions</li> <li>• to test predictions</li> </ul>	<p>(1) <b>Make predictions</b> and <b>Test predictions</b> by</p> <ul style="list-style-type: none"> <li>• conducting probability experiments and</li> <li>• recording results of the probability experiments.</li> </ul> <p>(2) Explore the fairness of games involving a variety of</p> <ul style="list-style-type: none"> <li>• spinners</li> <li>• dice</li> </ul>

<b>Grade Four</b> <b>WORKING WITH DATA: PROBABILITY AND STATISTICS</b> Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.		
<b>How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?</b>		
Students should...	Performance Standards	Expected Performances
<p>4.1 <b>Collect data</b> and <b>Organize data</b> and <b>Display data</b> using appropriate</p> <ul style="list-style-type: none"> <li>• statistical methods &amp;</li> <li>• graphical methods.</li> </ul>	<p>a. <b>Organize</b> and <b>Analyze</b></p> <ul style="list-style-type: none"> <li>• categorical data</li> <li>• numerical data</li> </ul>	<p>(1) Explore a variety of ways to</p> <ul style="list-style-type: none"> <li>• collect data</li> <li>• organize data</li> <li>• record data</li> <li>• analyze data</li> <li>• interpret data</li> <li>• identify patterns</li> <li>• identify trends</li> </ul> <p>(2) <b>Construct</b> and <b>Interpret</b></p> <ul style="list-style-type: none"> <li>• broken line graphs</li> <li>• line plots</li> <li>• bar graphs</li> <li>• picture graphs</li> <li>• glyphs (coded pictures)</li> <li>• simple circle graphs</li> </ul>
<p><b>Line Plot:</b> <i>A graph that shows the frequency of data along a number line</i></p> <p><b>Example:</b></p>	<p><b>Numerical data</b> are ordered numerically.</p> <p>- <b>Discrete Numerical Data:</b> <i>Counted Items (number of children, beats per minute)</i></p> <p>- <b>Continuous Numerical Data:</b> <i>Measured Characteristics (weight, voltage)</i></p> <p><b>Categorical data</b> are ordered arbitrarily. <i>Defined Characteristics (marital status, political party, eye color)</i></p>	<p><b>Broken Line Graphs</b> are used to show trends in data over time</p>
<p>Legend [GLYPH]</p> <p>Square Body = prefers science                      Rectangular Body = prefers math                      Circular Body = prefers reading                      Squiggly antennae = is 9 years or older                      Straight antennae = is between 8 and 9                      Zig Zag Antennae = is younger than 8</p>	<p><b>Grade 4 Continued on Next Page</b></p>	

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Students should...	Performance Standards	Expected Performances
4.2 Analyze data sets to <ul style="list-style-type: none"> <li>• form hypotheses and</li> <li>• make predictions</li> </ul> [ <i>data set: collection of data</i> ]	a. Describe what is “average” about the characteristics in a data set.	<b>(1)</b> Use the <b>range</b> and <b>mode</b> and <b>median</b> and <b>mean</b> to describe features of a data set.
<p><b><u>Range:</u></b> <i>The difference between the greatest and the least value in a set of data</i></p> <p><b><u>Mode:</u></b> <i>The number that appears most frequently in a set of numbers. There may be one, more than one, or no mode.</i></p> <p><b><u>Median:</u></b> <i>When the numbers are arranged from least to greatest, the middle number of a set of numbers, or the mean of two middle numbers when the set has two middle numbers</i></p> <p><b><u>Mean:</u></b> <i>The number found by dividing the sum of two or more addends by the number of addends. The mean is often referred to as the average.</i></p>		
4.3 <b>Understand</b> and <b>Apply</b> basic concepts of probability.  [ <i>Example of <b>Combination</b> Problem: Joe wants to make an ice cream sundae. He has 3 flavors of ice cream – vanilla, strawberry and chocolate. He has 2 types of sauce – fudge and peanut butter. He may use only one flavor of ice cream with one sauce. How many different sundaes can he make? Show all the different sundaes he can make.</i> ]	a. <b>Determine fair situations</b> and <b>Determine good choices</b> based upon the likelihood of an occurrence.	<b>(1)</b> Identify possible outcomes of events using <b>combinations</b> (where order does not matter).  Explore situations resulting in <b>permutations</b> (where order does matter.) <i>Example: batting order in baseball</i> <b>(2)</b> Conduct probability experiments and  Express the probability based on possible outcomes.

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Students should...	Performance Standards	Expected Performances
<p>4.1 <b>Collect data</b> and <b>Organize data</b> and <b>Display data</b> using appropriate</p> <ul style="list-style-type: none"> <li>• statistical methods &amp;</li> <li>• graphical methods.</li> </ul> <p><b>Line Plot:</b> <i>A graph that shows the frequency of data along a number line</i></p> <p><b>Example:</b></p>	<p>a. Differentiate between numerical data and categorical data</p> <p>Differentiate between the appropriate representations of numerical data and categorical data</p> <hr/> <p><b>Numerical data</b> are ordered numerically.</p> <p>- <b>Discrete Numerical Data:</b> <i>Counted Items (number of children, beats per minute)</i></p> <p>- <b>Continuous Numerical Data:</b> <i>Measured Characteristics (weight, voltage)</i></p> <hr/> <p><b>Categorical data</b> are ordered arbitrarily. <i>Defined Characteristics (marital status, political party, eye color)</i></p>	<p><b>(1) Construct</b> and <b>Interpret</b></p> <ul style="list-style-type: none"> <li>• broken line graphs</li> <li>• line plots</li> <li>• bar graphs</li> <li>• picture graphs</li> <li>• simple circle graphs</li> <li>• stem and leaf plots</li> </ul> <p><i>(See last page of this document)</i></p> <hr/> <p>Evaluate how well each kind of display represents the features of the data.</p> <hr/> <p><b>Broken Line Graphs</b> are used to show trends in data over time</p>

Grade Five		
WORKING WITH DATA: PROBABILITY AND STATISTICS		
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Students should...	Performance Standards	Expected Performances
4.2 Analyze data sets to <ul style="list-style-type: none"> <li>form hypotheses and</li> <li>make predictions</li> </ul> [data set: collection of data]	Examine different data collection methods and their affect.	(1) <b>Design surveys</b> and <b>Conduct surveys</b> and <b>Conduct samplings</b> to collect data that represent a general population  (2) Explore how a change in an <b>outlier</b> can change the <b>measures of central tendency</b> .
<div style="border: 1px solid black; padding: 5px;"> <p><b>Outlier:</b> A number in a set of data that is much larger or smaller than most of the other numbers in the set (1, 52, 55, 55, 57, 59, 125)</p> </div>		

**Measures of Central Tendency:** Measures of central tendency are measures of the location of the middle or the center of a distribution. The definition of "middle" or "center" is purposely left somewhat vague so that the term "central tendency" can refer to a wide variety of measures. The mean is the most commonly used measure of central tendency

**Mode:** The number that appears most frequently in a set of numbers. There may be one, more than one, or no mode.

**Median:** When the numbers are arranged from least to greatest, the middle number of a set of numbers, or the mean of two middle numbers when the set has two middle numbers

**Mean:** The number found by dividing the sum of two or more addends by the number of addends. The mean is often referred to as the average.

4.3 <b>Understand</b> and <b>Apply</b> basic concepts of probability.	a. Relate the likelihood of an event to a numerical value.	(1) Identify possible outcomes and  Express the likelihood of events as a fraction.  (2) <b>Design</b> and <b>Conduct</b> <ul style="list-style-type: none"> <li>probability experiments</li> <li>games of chance</li> </ul> (3) <b>Make predictions</b> and <b>Test predictions</b> of <ul style="list-style-type: none"> <li>probability</li> <li>fairness</li> </ul>
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**Stem-and-Leaf Plots** allow you to organize the numbers in your data so that the numbers themselves make the display.

Usually, a stem and leaf plot is *ordered*, which simply means that the leaves are arranged in ascending order from left to right. Also, there is no need to separate the leaves (digits) with punctuation marks (commas or periods) since each leaf is always a single digit. Using the data from Table 2, we made the **ordered** stem-and-leaf plot shown in Table 3.

Student	Number of Books Read
Al	6
Ben	7
Cate	10
Dale	12
Ellen	12
Frank	15
Greg	19
Hank	21
Ivy	23
June	25

Stem	Leaf
0	6 7
1	0 2 2 5 9
2	1 3 5