

# Mathematics Tools Practice Guide

**For use with the 2016 Mathematics SOL and**

**2023 Mathematics SOL (Field-test items)**

**Practice Items in TestNavTM 8**

**March 2024**

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## Introduction to TestNavTM 8: MC/TEI Document

The [*Introduction to TestNav 8*: *Multiple-Choice/Technology Enhanced Item Tests*](https://www.doe.virginia.gov/home/showpublisheddocument/20825/638255443523500000)documentserves as an introduction to the online navigation, tools, accessibility features, and overall functionality and appearance of TestNav 8. It is highly recommended that teachers (or other adults) read the *Introduction to TestNav 8: MC/TEI*document prior to reading this guide for the Mathematics Tools Practice.

Reading the *Introduction to TestNav 8: MC/TEI*document will give teachers an understanding of the features of TestNav 8 prior to working with students**.** In part, the document provides information on:

* opening the practice item sets within the required TestNav 8 Application,
* navigating through the practice item sets,
* answering technology-enhanced items (TEI) and multiple-choice items,
* using the online tools, and
* using the accessibility features available in TestNav 8.

This important information should be used in conjunction with the information found in this guide.

## Guided Practice Suggestions

This guide provides practice suggestions for each question in the Mathematics Tools practice item set. The “Guided Practice Suggestions” contains information for teachers to use at various grade levels as they guide students through the items. For instance, guided practice suggestions can state, “Use the ruler tool to measure line segment AB” or “Use the protractor to measure an angle.” Following the suggestions in the table will ensure that students are exposed to all of the different tools within TestNav 8 and experience using these tools with their mouse, keypad, or touchscreen.

## Online Tools, Features, Icons, and Descriptions of Function

Pointer 

Use to select an answer on screen and to place the cursor in an answer box, plot points, select one or more answers, and drag information from one location to another.

Answer Eliminator 

Use to eliminate (cross off) answer options. This tool functions with multiple-choice questions and certain TEI items.

Inch Ruler 

Use to measure an object on the screen.

Centimeter Ruler 

Use to measure an object on the screen.

Protractor 

Use to measure an angle.

Straightedge 

The tool will be accessed via the tool bar. Only one straightedge can be used on an item and the tool cannot be used in conjunction with the other tools accessed through the tool bar (ie. ruler, protractor). The student moves the straightedge ends by selecting either end and dragging.

Desmos Calculator 

This tool will be used for mathematical calculations. Grades 4 and 5 will have the Desmos Four-Function calculator for calculator active items. Grades 6-8 will have the Desmos Scientific calculator for calculator active items, and end-of-course (EOC) mathematics items will have the Desmos Graphing calculator. For additional information on [Desmos](https://www.desmos.com), please refer to the [Desmos FAQ](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/desmos-faq.docx) document and the [Desmos](https://www.desmos.com) web page.

Highlighter 

Use to highlight text. Students cannot highlight art, pictures, images, or text when it is presented as art (i.e. poems, fliersDesmos).There is no limit to the number of highlights a student can make within the test. To access the highlighter, the student selects text and selects the highlighter color. To remove the highlighted text, the student selects the highlighted text and selects the slash. Pink and blue are the two highlighter colors available when the background and foreground setting is set to the default (black text on white background). These colors may change when the background and foreground setting is changed.

Exhibit Window 

Use to view exhibits such as Formula Sheets and z-tables.

Drawing Interaction Tool 

Many items have the Drawing Interaction Tool available for students to use. The Drawing Interaction Tool is a boxed area that exists on certain mathematics and science questions. The student selects the appropriate tool for the item and uses it to help answer the question.

The tools are located to the right of the drawing interaction area. The individual tools are:

* Pencil or straight line 

The pencil may be used to make marks, notations, straight lines, or dots on or around artwork or graphs inside the Drawing Interaction area. The arrow in the bottom right corner expands the tool so a student may select free draw or the straight line. A dot may be placed if a student uses his mouse, keypad, or touch screen. The student would select free draw and use his mouse or keypad to click and release to place a point. If using a touch screen, the student would use his finger to place a point.

* Compass 

Students should use the solid black dot, which is the compass point, to move the compass to a desired location. Students will use the middle gray circle to lengthen or shorten the drawing radius. The dashed circle indicates the length of the drawing radius. The length of the drawing radius will not change unless the middle gray circle is selected. The small open circle on the arrow is the compass pencil. This will be used to draw the arcs. To move the compass after beginning a construction, students should use the compass point, not the middle gray circle.

* Eraser - used to erase selected lines, markings, or writing 
* Color selector - allows the markings to be black or green 
The arrow in the bottom right corner expands the tool so a student may select the color.
* Mark thickness - allows students to select the thickness of the markings 
The arrow in the bottom right corner expands the tool so a student may select the size.
* Undo or Redo - removes the most recent markings 
* Clear All - allows all markings to be eliminated at the same time 

## Mathematics Tools Practice Item Information and Recommended Guided Practice Suggestions

The *Mathematics Tool Practice* suggestions are ideas for teachers to use with students during classroom instruction. These suggestions are *not* intended to be test items and are not intended to cover all content for the grade level. Activities for each question have been designed to give students at different grade levels the opportunity to become familiar with these tools’ interaction and functionality. To maximize the opportunity for tools practice, there may be tools available on items that students at different grade levels would not be familiar with or have access to during an actual Standards of Learning (SOL) test. For example, the compass tool is available on ALL items in this set but would only be used by End-of-Course (EOC) geometry students.

### Grades 3-5 Practice Suggestions

#### Question 1

Use the ruler tool to practice measuring.

1. Measure the length of the crayon to the nearest ½ inch.
2. Measure the length of the crayon to the nearest centimeter (cm) and/or millimeter (mm).
3. Measure the length of the screwdriver to the nearest ½ inch and/or nearest 1/8 inch.
4. Measure the length of the screwdriver to the nearest centimeter (cm) and/or millimeter (mm).

#### Question 2

 Use the ruler tool to practice measuring.

1. Find the perimeter of figure *ABCDE* to the nearest ½ inch.
2. Find the perimeter of figure *FGHJ* to the nearest centimeter (cm).

Identify the vertices of each figure.

Identify each polygon.

Use the straightedge or the straight-line tool to draw segment *FH* in figure *FGHJ*. Classify the two resulting triangles according to sides and according to angle measures.

Classify each angle in figure *ABCDE*.

Use the straightedge or the straight-line tool to draw a line segment from point *B* to point *D* on figure *ABCDE*; identify and name the polygons that result after subdividing the figure.

#### Question 3

Use the ruler tool to practice measuring.

1. Find the perimeter of figure *ABC* to the nearest centimeter (cm).
2. Measure the length of segment *NH* to the nearest centimeter (cm) and/or millimeter (mm).

Identify the vertices of each figure.

Name each polygon.

Classify each angle in figure *ABC* and in figure *HJKLMN*.

Name two segments that appear parallel in figure *HJKLMN*.

Use the straightedge or the straight-line tool to draw a line segment from point *N* to point *K* on figure *HJKLMN*; identify and name the polygons that result after subdividing the figure.

#### Question 4

Use the ruler to practice measuring.

1. Measure the length of line segment *BC* to the nearest 1/8 inch.
2. Measure the length of line segment *EF* to the nearest centimeter (cm).

Identify a ray.

Identify a line segment.

Name an angle.

Identify the vertex of each angle.

Use the protractor tool to approximate the measure of each angle.

#### Question 5

No practice suggestions for grades 3-5.

**Question 6**

Enter an equivalent expression to a given expression using whole numbers, decimals, fractions, or mixed numbers.

Create an expression/equation to represent a contextual problem.

Create a fraction, mixed number, or decimal to represent a model.

Note for teachers: Students in grades 3-5 will NOT have the negative symbol enabled on the equation palette in any test item that will be field-tested in spring 2024.

**Question 7**

Create an expression to compare two given fractions, decimals, or mixed numbers.

Enter an equivalent equation to a given equation using whole numbers, decimals, fractions, or mixed numbers.

Create an expression/equation using a single variable from a contextual situation.

Note for teachers: Either the minus or the negative symbol may be used on the palette, and both would score correct. Students in grades 3-5 will NOT have the negative symbol enabled on the equation palette in any test item that will be field-tested in spring 2024.

**Question 8**

No practice suggestions for grades 3-5.

#### **Question 9**

No practice suggestions for grades 3-5.

#### Question 10

Draw a line segment that appears to be parallel to line segment AB.

Draw a line segment that intersects line segment *AB*.

Draw a line segment that appears to be perpendicular to line segment *AB*.

#### Question 11

Describe the figure shown.

Measure angle *A*.

Classify angle *A*.

#### Question 12

Draw a line segment through point A that appears to be parallel to line m.

Draw a line segment through point *A* that intersects line *m.*

Draw a line segment through point *A* that appears to be perpendicular to line *m*.

Use the ruler to measure the distance between points *A* and *B* to the nearest centimeter (cm).

#### Question 13

 Use the ruler to practice measuring.

1. Measure the length of line segment *AC* to the nearest centimeter (cm).
2. Measure the length of line segment *BC* to the nearest 1/8 inch (in).

Find the perimeter of the figure.

Use the protractor tool to approximate the measure of angle *A*.

Classify the triangle.

#### Question 14

 Use the ruler to practice measuring.

1. Measure the distance between points *A* and *B* to the nearest ¼ inch (in).
2. Measure the distance between points *A* and *B* to the nearest centimeter (cm).

Use the straight-line tool to draw a line segment that extends from point *A* through point *B* and to a point on the opposite side of the circle.

Draw and identify a radius, a diameter, a chord, and the center of the circle.

**Question 15**

No practice suggestions for grades 3-5.

**Question 16**

No practice suggestions for grades 3-5.

### Grades 6-8 Practice Suggestions

#### Question 1

No practice suggestions for grades 6-8.

#### Question 2

Use the protractor tool to practice measuring.

1. Measure angle *ABC* to the nearest degree.
2. Measure angle *FGH* to the nearest degree.

Use the straightedge or straight-line tool to determine apparent lines of symmetry in figure *ABCDE* and in figure *FGHJ*.

#### Question 3

Use the protractor and/or rulers to determine regular polygons.

Use the straightedge or straight-line tool to determine apparent lines of symmetry in each figure.

Use the straight-line tool to draw line segment *DF* in figure *DEFG*. Name the two similar figures formed. Identify the corresponding sides and corresponding angles of the two similar figures formed.

#### Question 4

Use the protractor tool to find the measure of each angle to the nearest degree.

#### Question 5

Determine in which quadrant point A is located.

Determine the coordinates of point *B*.

Identify the coordinates of *A*' if point *A* is reflected across the *x*-axis.

Identify the coordinates of *B*' if point *B* is reflected across the *y*-axis.

Use the mark thickness tool to plot a point and the straight-line tool to draw two line segments to form the legs of a right triangle that includes line segment *AB* as the hypotenuse. Translate the right triangle five units to the right and four units down; determine the coordinates of the resulting image.

Use the pencil and/or straight-line tool to draw slope triangles to determine the slope of line segment *AB*.

**Question 6**

Create a fraction, mixed number, or decimal to represent a given equivalent expression, model, or number line.

**Question 7**

Create an expression/equation/inequality to represent a model or contextual problem.

Create an expression to compare integers using mathematical symbols.

Create an expression to represent a relationship between two quantities using ratios.

Note for teachers: Either the minus or the negative symbol may be used on the palette, and both would score correct.

**Question 8**

Create an expression/equation to represent a given equivalent expression/equation using fractions, decimals, percents, exponents, and/or radicals.

Create an expression/equation/inequality to represent a model or contextual problem.

Create an expression to compare integers using mathematical symbols.

Note for teachers: Either the minus or the negative symbol may be used on the palette, and both would score correct.

#### Question 9

Practice plotting two points on the coordinate grid to form a line.

Practice removing points and lines from the coordinate grid. *(Note: the pre-plotted line cannot be removed.)*

#### Question 10

No practice suggestions for grades 6-8.

#### Question 11

Use the protractor to measure angle A to the nearest degree.

Determine the measures of the complement and supplement of angle *A*.

#### Question 12

Use the straight-line tool to draw a line that extends through points A and B. Place point C on line m to the left of point B and point D on line m to the right of point B. Identify any vertical, adjacent, supplementary, or complementary angles in the figure.

#### Question 13

 Use the protractor tool to measure each of the angles to the nearest degree.

1. Angle *A*
2. Angle *B*
3. Angle *C*

Determine if the measure of line segment *AC* is congruent to the measure of line segment *BC*.

Determine the number of lines of symmetry of the triangle.

#### Question 14

Draw and measure the length of a radius of circle B to the nearest centimeter (cm).

Approximate the area and circumference of circle *B*.

**Question 15**

No practice suggestions for grades 6-8.

**Question 16**

No practice suggestions for grades 6-8.

### EOC Practice Suggestions

#### Question 1

Use the figures to practice constructions. Students may need to use the mark thickness tool to plot a point necessary to the construction.

1. Construct a perpendicular bisector to the line segment that indicates the length of the crayon.
2. Construct a perpendicular bisector to the line segment that indicates the length of the screwdriver.
3. Construct the midpoint of the line segment that indicates the length of the screwdriver.

#### Question 2

Use the figure to practice constructions. Students may need to use the mark thickness tool to plot a point necessary to the construction.

1. Construct the angle bisector of angle *BCD*.
2. Construct the angle bisector of angle *FJH*.
3. Construct a line segment congruent to line segment *CD*.
4. Construct a perpendicular bisector to line segment *BC*.

Determine the number of lines of symmetry in figure *ABCDE* and in figure *FGHJ*.

#### Question 3

Construct an angle congruent to angle A.

Regular hexagon *HJKLMN* has a side length of 1 inch. Determine the area of the figure.

#### Question 4

Use the figure to practice constructions.

1. Construct the angle bisector for each of the given angles.
2. Construct an angle twice the measure of angle *H*.

#### Question 5

Use the grid to practice constructions.

1. Construct a line perpendicular to line segment *AB* through a point with coordinates *(x,y).* *(Teacher may select the coordinates of a point NOT on the line segment.)*
2. Construct a line perpendicular to line segment AB through a point with coordinates *(x,y).* *(Teacher may select the coordinates of a point on the line segment.)*
3. Determine the slope of line segment *AB* and write the equation of the line on which it lies.
4. Determine the midpoint of line segment *AB*.
5. Determine the length of line segment *AB*.

#### Question 6

No practice suggestions for EOC Mathematics.

**Question 7**

Create an algebraic expression to represent a given contextual situation.

Note for teachers: Either the minus or the negative symbol may be used on the palette, and both would score correct.

**Question 8**

Create an algebraic expression to represent a given contextual situation.

Represent the factors of a polynomial expression.

Create an equivalent radical/rational expression to a given radical/rational expression.

Provide a simplified result of an algebraic expression.

Note for teachers: Either the minus or the negative symbol may be used on the palette, and both would score correct.

#### Question 9

Plot two points to create a line parallel to the given line.

Plot two points to create a line perpendicular to the given line.

#### Question 10

Use the figure to practice constructions. Students may need to use the mark thickness tool to plot a point necessary to the construction.

1. A perpendicular bisector of the line segment.
2. A midpoint of the line segment.
3. A perpendicular to line segment AB from a point not on the line segment. (Students will need to place a point on their screen to complete this construction.)

#### Question 11

Use the figure to practice constructions:

1. An angle congruent to the given angle.
2. A bisector of the angle.
3. An angle twice the measure of the given angle.

#### Question 12

Use the figure to practice constructions. Students may need to use the mark thickness tool to plot a point necessary to the construction.

1. A line parallel to line *m* through point *A.*
2. A line perpendicular to line *m* through point *B.*
3. A line perpendicular to line *m* through point *A.*

#### Question 13

Use the figure to practice constructions:

1. A line segment congruent to line segment *AB.*
2. A perpendicular bisector of a line segment.
3. A midpoint of a line segment.
4. An angle congruent to a given angle.
5. A bisector of a given angle.

Determine the number of lines of symmetry of the triangle.

#### Question 14

Use the figure to construct an equilateral triangle, a square, or a regular hexagon inscribed in a circle.

**Question 15**

Create an algebraic expression to represent a given contextual situation.

Represent the factors of a polynomial expression.

Create an equivalent radical/rational expression to a given radical/rational expression.

Provide a simplified result of an algebraic expression.

Note for teachers: Either the minus or the negative symbol may be used on the palette, and both would score correct.

**Question 16**

Create an equation to determine the measure of a missing angle/side using trig.

Represent the complex factors of a quadratic expression.

Represent a solution in terms of pi.

Create an exponential/logarithmic equation to represent a given graph.

Create a polynomial equation to represent a given model/graph.

Note for teachers: Either the minus or the negative symbol may be used on the palette, and both would score correct.