

Approximate and Locate



Grade 8 | NC.8.NS.2

Teacher scripts, original models and student organizers
30 multiple-choice + 30 open/performance tasks
Worked keys and individual evidence records

Current NC standards for 2026-27 and 2027-28. Select tasks across several sessions. This resource bank is not one test.

Free sample | Contents

NC.8.NS.2 | Eighth Grade mathematics

This sample contains 20 complete selected pages from the 93-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-16, 31-32, 61, 76

Representative activities

M01: sample PDF page(s) 17; original page(s) 16

M02: sample PDF page(s) 17; original page(s) 16

O01: sample PDF page(s) 18; original page(s) 31

O02: sample PDF page(s) 19; original page(s) 32

Selected teacher prompts and keys: original page(s) 61, 76

Using this sample

Read the preparation and access guidance before using a selected activity.

Keep teacher keys and private preparation pages separate from student copies.

Use the original resource contents to see the scope of the complete packet.

Complete paid download

The complete resource includes the full PDF task bank and teaching materials.

TEACHER GUIDE

Exact standard and scope

Use rational approximations of irrational numbers to compare the size of irrational numbers and locate them approximately on a number line. Estimate the value of expressions involving:

- Square roots and cube roots to the tenths.
- π to the hundredths.

Domain: THE NUMBER SYSTEM

Cluster: Know that there are numbers that are not rational, and approximate them by rational numbers.

Current NC wording and numerical limits are retained. Adopted 2026 revisions beginning in 2028-29 are not substituted.

TEACHER GUIDE

Targets and evidence

Square: Approximate a square root to tenths using bounds.

Evidence: M01, M14, M15, M16, M21, O01, O09, O11, O21, O22

Cube: Approximate a cube root to tenths using bounds.

Evidence: M06, M09, M20, M24, M30, O08, O14, O15, O23, O30

Negative: Approximate and locate a negative cube root to tenths.

Evidence: M05, M12, M17, M19, M25, O03, O07, O16, O25, O29

Compare: Compare and locate roots using rational approximations.

Evidence: M03, M11, M26, M27, M29, O06, O12, O13, O17, O20

Pi: Estimate an expression involving π to hundredths.

Evidence: M02, M04, M10, M18, M23, O02, O04, O18, O24, O28

Expression: Estimate an expression involving a square root to tenths.

Evidence: M07, M08, M13, M22, M28, O05, O10, O19, O26, O27

MP2: connect quantities and symbols. MP3: justify claims. MP6: attend to signs, notation and precision. Open tasks collect actual reasoning, calculations and representations.

TEACHER GUIDE

Plan and navigation

Use four sessions of about 25-35 minutes: warm-up/model; shared/partner work; independent work; reteach/exit. Select one M and one O item per section first, using targets to match prior learning. The remaining bank supports later practice and conferences, not a single 60-item test.

Warm-up: M01-M04 and O01-O04

I Do: M05-M08 and O05-O08

We Do: M09-M13 and O09-O13

Collaborative practice: M14-M18 and O14-O18

Independent practice: M19-M23 and O19-O23

Small-group reteach: M24-M27 and O24-O27

Exit ticket: M28-M30 and O28-O30

Contents: standard/targets; planning/access; worked model; anchor/organizer; seven scripts; 15 choice pages; 30 open pages; worked keys; rubric; evidence record; sources. Print only selected student pages. Keep teacher examples and keys separate.

TEACHER GUIDE

Preparation and access

Prerequisites: decimal place value, squared/cubed values, signed order and equal-interval lines. Check these separately before teaching the selected target.

Materials: pencil, ruler and supplied blank organizers. For approximation, a calculator may check a bound after the learner records the reasoning; it is not a substitute for explaining the bound. No special manipulatives are needed.

Access: neutral read-aloud, enlargement, high contrast, AAC/signing and dictated explanations. A scribe records student-directed steps exactly. Do not score handwriting, decoding or accent. Record calculator use and other access supports separately.

Answer-supplying cues include classifying the decimal for a learner, supplying a property, giving the rounding direction, or naming the missing equation solution. Preserve the first response and record later supported responses separately.

Differentiate by first using small perfect powers, simple fractions and explicit factors. Then change the representation or ask for a counterexample. Do not replace a required construction, calculation or justification with recognition.

N/O means unobserved, inaccessible or insufficient evidence. Zero is for observed interpretable incorrect work. These instructional ratings are not official mastery cutoffs. All instructional contexts and numerical data are invented.

WORKED TEACHER MODEL

Think aloud and connect

Say: "To locate $\sqrt{2}$, first $1^2 < 2 < 2^2$. Refine: $1.4^2 = 1.96 < 2 < 2.25 = 1.5^2$. The midpoint 1.45 has square 2.1025, which is above 2. So $\sqrt{2}$ lies below 1.45 and rounds to 1.4. Mark the exact root a little right of 1.4. For $\sqrt[3]{-10}$, $(-2.2)^3 = -10.648 < -10 < -9.261 = (-2.1)^3$. The midpoint -2.15 has cube -9.938375, so the root is below -2.15 and rounds to -2.2. For 2π , calculate 6.2831853 before rounding to 6.28. Keeping extra digits until the end avoids premature rounding."



$\sqrt{2} \approx 1.4$; the exact point is just to the right of 1.4.

TEACHER GUIDE

Anchor: definitions and checks

For nonnegative square roots, compare squares of nonnegative bounds. For cube roots, cubing preserves order for all real bounds.

Neighboring-tenth bounds locate the root but do not alone settle rounding. Test the midpoint, or use enough extra digits.

Approximation uses $\approx$; an exact equality needs exact values. Label the number-line scale with equal intervals.

For π expressions use the stated precision and round the final result to hundredths. Negative cube roots are included here. Square roots of negative radicands are outside the real-number scope.

Ask the learner to supply the mathematical decision. Read symbols neutrally and distinguish exact values from estimates.

REPRODUCIBLE STUDENT TOOL

Reasoning organizer

Name: _____ Date: _____ Item: _____

Given information / requested decision or value**Representation / definitions / equivalent steps****Answer / precision / all solutions when requested****Check / why the conclusion follows**

TEACHER GUIDE

Warm-up teaching script

Start with M01 and O01; save the rest through 04 for later. Target: Approximate a square root to tenths using bounds.

Launch | 2 minutes

Say: "What is known exactly, and what are you asked to determine? Restate the question before calculating." Read symbols neutrally. Do not identify the correct classification, property or sign.

Teach or elicit | 5-7 minutes

Say: "Show a definition, equivalent expression or power check that supports your answer." During shared practice invite individual steps; during independent and exit work collect first responses without supplying a method.

Probe the selected task | 3-5 minutes

Use O01. Teacher solution: $3.6^2 = 12.960 < 13 < 13.690 = 3.7^2$. The midpoint is 3.65; its square is 13.322500. Because the root is below that midpoint, round to 3.6. The power function is increasing on the interval used.

Respond | 3-5 minutes

If a learner relies only on a display or remembered rule, return to the relevant anchor. Use a different small example, then retry a fresh bank item. Record any supplied classification, property, sign or bound as a cue, not neutral access.

Close | 2 minutes

Each partner first records a solution independently, then compares the reasoning. Early finishers change one value or condition and test whether the method still works. Record the first response, access supports, cues, and a next step. Exit evidence guides later teaching; no speed threshold applies.

TEACHER GUIDE

I Do teaching script

Start with M05 and O05; save the rest through 08 for later. Target: Estimate an expression involving a square root to tenths.

Launch | 2 minutes

Say: "What is known exactly, and what are you asked to determine? Restate the question before calculating." Read symbols neutrally. Do not identify the correct classification, property or sign.

Teach or elicit | 5-7 minutes

Read the worked teacher model aloud, pausing after each equality or bound. Ask the learner to name what makes the next step valid. Keep this example separate from the student response.

Probe the selected task | 3-5 minutes

Use O05. Teacher solution: $\sqrt{11} \approx 3.316625$; add 3 to obtain approximately 6.316625. The nearest tenth is 6.3. Adding an integer shifts the root interval by that integer. Bounds: $3.3^2 = 10.89 < 11 < 11.56 = 3.4^2$. Shift to (6.3, 6.4). The root midpoint 3.35 has square 11.2225, so the root is below it.

Respond | 3-5 minutes

If a learner relies only on a display or remembered rule, return to the relevant anchor. Use a different small example, then retry a fresh bank item. Record any supplied classification, property, sign or bound as a cue, not neutral access.

Close | 2 minutes

Each partner first records a solution independently, then compares the reasoning. Early finishers change one value or condition and test whether the method still works. Record the first response, access supports, cues, and a next step. Exit evidence guides later teaching; no speed threshold applies.

TEACHER GUIDE

We Do teaching script

Start with M09 and O09; save the rest through 13 for later. Target: Approximate a square root to tenths using bounds.

Launch | 2 minutes

Say: "What is known exactly, and what are you asked to determine? Restate the question before calculating." Read symbols neutrally. Do not identify the correct classification, property or sign.

Teach or elicit | 5-7 minutes

Say: "Show a definition, equivalent expression or power check that supports your answer." During shared practice invite individual steps; during independent and exit work collect first responses without supplying a method.

Probe the selected task | 3-5 minutes

Use O09. Teacher solution: $2.4^2 = 5.760 < 6 < 6.250 = 2.5^2$. The midpoint is 2.45; its square is 6.002500. Because the root is below that midpoint, round to 2.4. The power function is increasing on the interval used.

Respond | 3-5 minutes

If a learner relies only on a display or remembered rule, return to the relevant anchor. Use a different small example, then retry a fresh bank item. Record any supplied classification, property, sign or bound as a cue, not neutral access.

Close | 2 minutes

Each partner first records a solution independently, then compares the reasoning. Early finishers change one value or condition and test whether the method still works. Record the first response, access supports, cues, and a next step. Exit evidence guides later teaching; no speed threshold applies.

TEACHER GUIDE

Collaborative practice teaching script

Start with M14 and O14; save the rest through 18 for later. Target: Approximate a cube root to tenths using bounds.

Launch | 2 minutes

Say: "What is known exactly, and what are you asked to determine? Restate the question before calculating." Read symbols neutrally. Do not identify the correct classification, property or sign.

Teach or elicit | 5-7 minutes

Say: "Show a definition, equivalent expression or power check that supports your answer." During shared practice invite individual steps; during independent and exit work collect first responses without supplying a method.

Probe the selected task | 3-5 minutes

Use O14. Teacher solution: $1.8^3 = 5.832 < 6 < 6.859 = 1.9^3$. The midpoint is 1.85; its cube is 6.331625. Because the root is below that midpoint, round to 1.8. The power function is increasing on the interval used.

Respond | 3-5 minutes

If a learner relies only on a display or remembered rule, return to the relevant anchor. Use a different small example, then retry a fresh bank item. Record any supplied classification, property, sign or bound as a cue, not neutral access.

Close | 2 minutes

Each partner first records a solution independently, then compares the reasoning. Early finishers change one value or condition and test whether the method still works. Record the first response, access supports, cues, and a next step. Exit evidence guides later teaching; no speed threshold applies.

TEACHER GUIDE

Independent practice teaching script

Start with M19 and O19; save the rest through 23 for later. Target: Estimate an expression involving a square root to tenths.

Launch | 2 minutes

Say: "What is known exactly, and what are you asked to determine? Restate the question before calculating." Read symbols neutrally. Do not identify the correct classification, property or sign.

Teach or elicit | 5-7 minutes

Say: "Show a definition, equivalent expression or power check that supports your answer." During shared practice invite individual steps; during independent and exit work collect first responses without supplying a method.

Probe the selected task | 3-5 minutes

Use O19. Teacher solution: $\sqrt{33} \approx 5.744563$; add 4 to obtain approximately 9.744563. The nearest tenth is 9.7. Adding an integer shifts the root interval by that integer. Bounds: $5.7^2 = 32.49 < 33 < 33.64 = 5.8^2$. Shift to (9.7, 9.8). The root midpoint 5.75 has square 33.0625, so the root is below it.

Respond | 3-5 minutes

If a learner relies only on a display or remembered rule, return to the relevant anchor. Use a different small example, then retry a fresh bank item. Record any supplied classification, property, sign or bound as a cue, not neutral access.

Close | 2 minutes

Each partner first records a solution independently, then compares the reasoning. Early finishers change one value or condition and test whether the method still works. Record the first response, access supports, cues, and a next step. Exit evidence guides later teaching; no speed threshold applies.

TEACHER GUIDE

Small-group reteach teaching script

Start with M24 and O24; save the rest through 27 for later. Target: Estimate an expression involving π to hundredths.

Launch | 2 minutes

Say: "What is known exactly, and what are you asked to determine? Restate the question before calculating." Read symbols neutrally. Do not identify the correct classification, property or sign.

Teach or elicit | 5-7 minutes

Say: "Show a definition, equivalent expression or power check that supports your answer." During shared practice invite individual steps; during independent and exit work collect first responses without supplying a method.

Probe the selected task | 3-5 minutes

Use O24. Teacher solution: $12 \times 3.14159265 = 37.69911180$. The thousandths digit determines rounding, giving 37.70. Using 3.14 before the operation may change the final hundredth.

Respond | 3-5 minutes

If a learner relies only on a display or remembered rule, return to the relevant anchor. Use a different small example, then retry a fresh bank item. Record any supplied classification, property, sign or bound as a cue, not neutral access.

Close | 2 minutes

Each partner first records a solution independently, then compares the reasoning. Early finishers change one value or condition and test whether the method still works. Record the first response, access supports, cues, and a next step. Exit evidence guides later teaching; no speed threshold applies.

TEACHER GUIDE

Exit ticket teaching script

Start with M28 and O28; save the rest through 30 for later. Target: Estimate an expression involving π to hundredths.

Launch | 2 minutes

Say: "What is known exactly, and what are you asked to determine? Restate the question before calculating." Read symbols neutrally. Do not identify the correct classification, property or sign.

Teach or elicit | 5-7 minutes

Say: "Show a definition, equivalent expression or power check that supports your answer." During shared practice invite individual steps; during independent and exit work collect first responses without supplying a method.

Probe the selected task | 3-5 minutes

Use O28. Teacher solution: $7 + 3.14159265 = 10.14159265$. The thousandths digit determines rounding, giving 10.14. Using 3.14 before the operation may change the final hundredth.

Respond | 3-5 minutes

If a learner relies only on a display or remembered rule, return to the relevant anchor. Use a different small example, then retry a fresh bank item. Record any supplied classification, property, sign or bound as a cue, not neutral access.

Close | 2 minutes

Each partner first records a solution independently, then compares the reasoning. Early finishers change one value or condition and test whether the method still works. Record the first response, access supports, cues, and a next step. Exit evidence guides later teaching; no speed threshold applies.

STUDENT CHOICE

Choice practice 1-2

M01 | Estimate $\sqrt{11}$ to the nearest tenth.

- A. 3.2
- B. 2.9
- C. 3.3
- D. 3.1

Reasoning notes: _____

M02 | Estimate $4 \times \pi$ to the nearest hundredth. Use $\pi \approx 3.14159265$ and round only the final result.

- A. 12.56
- B. 12.57
- C. 12.53
- D. 12.55

Reasoning notes: _____

STUDENT PERFORMANCE

001 | Warm-up

Target: Approximate a square root to tenths using bounds.

Estimate $\sqrt{13}$ to the nearest tenth. Show two neighboring-tenth bounds and test the midpoint. On the blank number line label the bounds, subdivide equally and mark the root approximately.



Label equal intervals and a suitable scale. Place the requested values.

Bounds / midpoint test / calculations

Conclusion / explanation / check

STUDENT PERFORMANCE

002 | Warm-up

Target: Estimate an expression involving π to hundredths.

Estimate $9 \times \pi$ to the nearest hundredth. Use $\pi \approx 3.14159265$ and round only the final result. Show substitution, the unrounded result and the final rounding decision.

Definitions / equations / calculations / requested diagram

Answer / justification / check

TEACHER ONLY

M worked keys 1-2

M01: C. 3.3

Target: Approximate a square root to tenths using bounds.

$3.3^2 = 10.890 < 11 < 11.560 = 3.4^2$. The midpoint is 3.35; its square is 11.222500. Because the root is below that midpoint, round to 3.3. The power function is increasing on the interval used.

Option checks: 3.2: It differs from the verified answer by $-1/10$; compare the first non-equivalent step. The choice alone does not diagnose a unique error. 2.9: It differs from the verified answer by $-2/5$; compare the first non-equivalent step. The choice alone does not diagnose a unique error. 3.1: It differs from the verified answer by $-1/5$; compare the first non-equivalent step. The choice alone does not diagnose a unique error.

M02: B. 12.57

Target: Estimate an expression involving π to hundredths.

$4 \times 3.14159265 = 12.56637060$. The thousandths digit determines rounding, giving 12.57. Using 3.14 before the operation may change the final hundredth.

Option checks: 12.56: It differs from the verified answer by $-1/100$; compare the first non-equivalent step. The choice alone does not diagnose a unique error. 12.53: It differs from the verified answer by $-1/25$; compare the first non-equivalent step. The choice alone does not diagnose a unique error. 12.55: It differs from the verified answer by $-1/50$; compare the first non-equivalent step. The choice alone does not diagnose a unique error.

TEACHER ONLY

O worked keys 1-2

001: 3.6

Target: Approximate a square root to tenths using bounds.

$3.6^2 = 12.960 < 13 < 13.690 = 3.7^2$. The midpoint is 3.65; its square is 13.322500. Because the root is below that midpoint, round to 3.6. The power function is increasing on the interval used.

Accept equivalent exact forms and valid explanations. Assess the requested process as well as the final result. The line needs equal intervals, labeled scale and correctly ordered approximate points.

002: 28.27

Target: Estimate an expression involving π to hundredths.

$9 \times 3.14159265 = 28.27433385$. The thousandths digit determines rounding, giving 28.27. Using 3.14 before the operation may change the final hundredth.

Accept equivalent exact forms and valid explanations. Assess the requested process as well as the final result. A final number or label alone is incomplete when justification is requested.