Unit 10: Grade 7 Bridge — Signed Rationals, 2-Step Equations & Probability — Arctic Weather Swings, Go-Kart Tracks & Token Jars (Grade 7 Bridge)

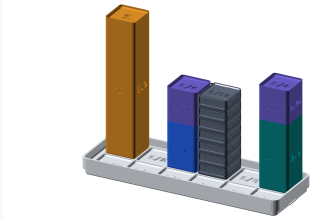
Adding, Subtracting, Multiplying & Dividing Signed Rationals, Two-Step Equations, and Probability/Combinatorics

As the summer wraps up, Kai, Leo, Zoe, and Maya run into challenges where two rules happen at the same time. During a camp trivia night, Kai's team was sitting at -15 points when the judge canceled a -25-point penalty, and nobody at the table could agree whether their score went up to +10 or dropped to -40. At the go-kart track, Leo had $38 to spend when admission cost $8 plus $6 per lap, and he wasn't sure which number to undo first.

In the bird-cognition lab, Zoe watched video from New Zealand showing wild kea parrots peering into clear jars filled with black reward tokens and white non-reward tokens. Before a lid was even opened, the parrots chose the jar with the better fraction of black tokens—while Maya tried to figure out why picking a 1st-2nd-3rd batting order gave six times as many possibilities as picking a 3-person cleanup crew.

Each of these puzzles combines multiple steps—signed numbers with fractions, multiplication with addition in a two-step equation, or counting outcomes where order does or does not matter.

Step by step, the four friends discover that subtracting a negative penalty, unwrapping a two-step equation in reverse order, and comparing permutations (`[nPr]`) with combinations (`[nCr]`) follow clear, logical patterns—and they use their SC-6 calculators to verify every result on their way into seventh-grade math.



Real-World Mathematical Context & Two-Method Mastery • Hands-On Models: Place Value, Fraction & Prime Blocks

UNIT 10 LESSONS — LEARN TWO TEXTBOOK WAYS FIRST, THEN CHECK YOUR WORK ON THE SC-6 CALCULATOR

SEC 10.1 (pp.95–96) Adding and Subtracting Rational Numbers

Textbook Ways: Way 1: Zero-Pair Cancellation | Way 2: Number-Line Jumps | Way 3: Absolute Value Sign Rules & Add-the-Opposite

Learn by Hand: To add two numbers with the SAME sign, add their absolute values and keep the common sign (-6 + (-4) = -10). To add two numbers with DIFFERENT signs, subtract the lesser absolute value from the greater absolute value and keep the sign of the number with the greater absolute value (-8 + 5 = -3). To subtract any signed number, add its opposite: a - b = a + (-b), so 10 - (-4) = 10 + 4 = 14.

Check Your Work on the SC-6 Calculator:

[f] [↔] 8 [+/−] [ENTER] 5 [+] 6 [+/−] [ENTER] 4 [+/−] [+]

Use zero-pair chips or a number line on paper first. On your SC-6, open [f][LINE] Number Line Mode (or [10F] zero-pair frame) and press 8 [+/-] [ENTER] 5 [+] to confirm -3, and 6 [+/-] [ENTER] 4 [+/-] [+] to confirm -10!

SEC 10.2 (pp.97–98) Multiplying and Dividing Rational Numbers

Textbook Ways: Way 1: Same/Different Sign Rules | Way 2: Repeated Addition / Equal Number-Line Jumps

Learn by Hand: When multiplying or dividing two non-zero numbers: if the signs are the SAME (both positive or both negative), the product or quotient is POSITIVE (+); if the signs are DIFFERENT, the product or quotient is NEGATIVE (-). In a product of multiple factors, an EVEN number of negative factors produces a positive result, and an ODD number of negative factors produces a negative result.

Check Your Work on the SC-6 Calculator:

6 [ENTER] 4 [+/−] [×] 5 [+/−] [x^2]

Press 6 [ENTER] 4 [+/-] [×] (-24) and 5 [+/-] [x^2] (+25).

SEC 10.3 (pp.99–100) Solving Two-Step Equations (ax + b = c)

Textbook Ways: Way 1: Two-Step Inverse Operations | Way 2: Balance Scale / Bar Model Unwrapping

Learn by Hand: A two-step equation contains two operations. To isolate the variable, undo the operations in the REVERSE order of operations: Step 1 undo addition or subtraction first to isolate the variable term (ax), and Step 2 undo multiplication or division second to isolate the variable x.

Check Your Work on the SC-6 Calculator:

2 8 [ENTER] 7 [-] 3 [÷] 2 8 [↑↓] 3 [×] 7 [+] [≠]

Press 28 [ENTER] 7 [-] 3 [÷] (7), then run the Equality Test 28 [ENTER] 3 [ENTER] 7 [×] 7 [+] [≠]—it flashes NO to confirm 3(7) + 7 = 28!

SEC 10.4 (pp.101–102) Theoretical Probability, Combinations & Permutations

Textbook Ways: Way 1: Probability Ratio & Complement Rule | Way 2: Tree Diagram / Outcome List | Way 3: Fundamental Counting Principle

Learn by Hand: Theoretical probability is the ratio of favorable outcomes to total equally likely outcomes: P(event) = Favorable ÷ Total, written as a simplified fraction, decimal, or percent. The probability of an event NOT occurring is the complement: P(not E) = 1 - P(E). For counting arrangements: n! counts ways to order all n items; nPr counts ordered permutations; and nCr counts unordered combinations.

Check Your Work on the SC-6 Calculator:

[•] 4 [•] 1 0 [g] [SIMP] 5 [x!]

Press [.] 4 [.] 10 [g][SIMP] to confirm 2/5, press 5 [x!] to confirm 5! = 120, and explore rolls with [DICE] or [f][1..x]!

HANDS-ON MODEL: PLACE VALUE BLOCKS

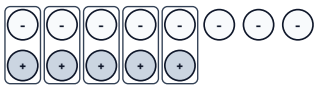
Section 10.1 — Practice A: Adding and Subtracting Rational Numbers

Key Vocabulary: additive inverse • zero pair • Same-Sign Sum Rule • Different-Sign Difference Rule • Add-the-Opposite (a - b = a + (-b))

Name: _____ Date: _____ Score: ____ / 100

TEXTBOOK CONCEPT & HANDS-ON MODEL (PLACE VALUE BLOCKS)

Way 2: Zero-Pair Counters (-8 + 5 = -3)



5 Zero Pairs cancel → 3 Red (-) left = -3

Same Signs: Add |x| | Diff Signs: Subtract |x|

Subtracting = Add the Opposite!

a - b = a + (-b)

a - (-b) = a + b

Ex: 10 - (-4) = 10 + 4 = 14

HOW THE TEXTBOOK & VISUAL MODEL WORK TOGETHER:

Textbook Addition Rules: Same signs → add absolute values and keep the common sign. Different signs → subtract absolute values and keep the sign of the larger |x|.

Textbook Subtraction Rule (Add the Opposite): To subtract any rational number, add its opposite: a - b = a + (-b), and a - (-b) = a + b.

WATCH OUT: To subtract a signed number, ADD ITS OPPOSITE: a - (-b) = a + b (subtracting a negative moves RIGHT on the number line)!

WORKED EXAMPLE — 3 TEXTBOOK WAYS (ANY 2 WAYS = +20 PTS)

Problem: Evaluate -8 + 5 and -6 + (-4).

WAY 1: Zero-Pair Cancellation Model
In -8 + 5, five (-1, +1) zero pairs cancel to 0, leaving 3 negatives (-3). In -6 + (-4), 6 negatives + 4 negatives = -10.

WAY 2: Horizontal Number-Line Jumps
For -8 + 5, start at -8 and move 5 units right → -3. For -6 + (-4), start at -6 and move 4 units left → -10.

WAY 3: Big Ideas Absolute Value Sign Rules
Different signs (-8 + 5): subtract |8| - |5| = 3, keep sign of -8 → -3. Same signs (-6 + -4): add |6| + |4| = 10, keep '-' → -10.

Answer: -8 + 5 = -3; -6 + (-4) = -10 1 Way = +10 | 2 Ways = +20!

CHECK YOUR WORK ON THE SC-6 CALCULATOR — SECTION 10.1 PRACTICE A (SOLVE BY HAND FIRST, THEN VERIFY!)

Worked Example SC-6 Check Keystrokes:

f ↔ 8 +/− ENTER 5 + 6 +/− ENTER 4 +/− +

Use zero-pair chips or a number line on paper first. On your SC-6, open [f][LINE] Number Line Mode (or [10F] zero-pair frame) and press 8 [+/-] [ENTER] 5 [+] to confirm -3, and 6 [+/-] [ENTER] 4 [+/-] [+] to confirm -10!

SECTION 10.1 PRACTICE A — KEY IDEAS & MULTI-METHOD PRACTICE

100-PT GOAL: Any 5 in 2 Ways (+20) OR All 10 in 1 Way (+10)!

1 Evaluate: (a) -15 + 9 and (b) -15 + (-9).

Starter Step 1: In (a) the signs are different, so subtract the absolute values (15 - 9) and keep the sign of -15; in (b) the signs are the same.

Way 1 (Paper Work):



WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

2 Evaluate: 14 + (-23).

Starter Step 1: Since 14 and -23 have different signs, subtract 23 - 14 and keep the sign of the number with the larger absolute value (-23).

Way 1 (Paper Work):



WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

3 Evaluate: (a) 12 - (-18) and (b) -12 - (-8).

Way 1 (Paper Work):



CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

4 Evaluate: -9 - 16.

Way 1 (Paper Work):



CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

5 Ice-Melting Science Lab: Pure water freezes at 0°C. Adding salt lowers the freezing point by 7.8°C, and adding beet extract lowers it by another 6.4°C. What is the new freezing point of the mixture?

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

6 Evaluate: 6.4 - 11.2.

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

7 Evaluate: -7.5 - (-10.2).

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

8 Evaluate: -3/4 - (-5/8).

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

9 Sub-Zero Week Temperature Swing: During a polar vortex week, the lowest recorded temperature was -22°F and the highest recorded temperature was +14°F. How many degrees warmer was the high temperature than the low temperature?

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

10 Evaluate the rational expression: -2 1/2 + 4 1/4 - (-1 1/8).

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

HANDS-ON MODEL: PLACE VALUE BLOCKS

Section 10.1 — Practice B: Modeling Real Life (Adding and Subtracting Rational Numbers)

Textbook Ways: Zero-Pair Cancellation | Number-Line Jumps | Absolute Value Sign Rules & Add-the-Opposite Name: _____ Date: _____ Score: ____ / 100

WORKED EXAMPLE — SUBTRACTING SIGNED RATIONAL NUMBERS (2 TEXTBOOK WAYS = +20 PTS DOUBLE)

Problem: A mountain sensor rises from -4°C to +10°C. Find the temperature change 10 - (-4), and evaluate -3/4 - (-5/8).

WAY 1: Add the Opposite (a - b = a + (-b))

Rewrite subtraction as adding the opposite: 10 - (-4) = 10 + (+4) = 14°C. For -3/4 - (-5/8): -6/8 + (+5/8) = -1/8.

WAY 2: Number-Line Distance from Start to End

From -4°C up to 0°C is +4°C, and from 0°C to +10°C is +10°C → total rise = 4 + 10 = +14°C. From -5/8 to -6/8 is -1/8.

Rule: Subtracting a negative (- (-b)) is the same as adding a positive (+ b).

WATCH OUT: To subtract a signed number, ADD ITS OPPOSITE: a - (-b) = a + b (subtracting a negative moves RIGHT on the number line)!

Answer: 14°C; and -1/8

CHECK YOUR WORK ON THE SC-6 CALCULATOR — SECTION 10.1 PRACTICE B (SOLVE BY HAND FIRST, THEN VERIFY!)

Worked Example SC-6 Check Keystrokes:

1 0 ENTER 4 +/− - • 3 • 4 +/− ENTER • 5 • 8 +/− -

Rewrite subtraction as adding the opposite on paper first. Check on your SC-6 (in [f][LINE] mode or with Two-Dot fractions): Press 10 [ENTER] 4 [+/-] [-] (+14°C) and [.] 3 [.] 4 [+/-] [ENTER] [.] 5 [.] 8 [+/-] [-] (-1/8).

During camp trivia night, Kai's team was sitting at -15 points when the host removed a -25-point penalty, writing -15 - (-25) on the board. Seeing two minus signs in a row made Kai's head spin, and half his team guessed their score dropped to -40. Then Kai thought about what 'removing a penalty' actually means in a game: taking away a 25-point loss is the exact same thing as giving the team +25 points! Rewriting - (-25) as + 25 turned the problem into -15 + 25 = +10 points—the same reason the vertical gap between a +4,800 m peak and a -200 m cave is 4,800 - (-200) = 5,000 m.

SECTION 10.1 PRACTICE B — MODELING REAL LIFE & APPLICATIONS

100-PT GOAL: Any 5 in 2 Ways (+20) OR All 10 in 1 Way (+10)!

1 **Arctic Temperature Swing: At dawn the temperature is -14°F. By noon it warms up by 22°F. What is the temperature at noon?**

Starter Step 1: Write -14 + 22: since the signs are different, find the difference between 22 and 14 and keep the sign of the larger magnitude.

Way 1 (Paper Work):



WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

2 **Submarine Double Dive: A research submarine is at -45 meters and dives another 38 meters deeper. What is its new elevation?**

Starter Step 1: Write -45 + (-38): since both changes are negative (diving deeper), add their magnitudes and keep the negative sign.

Way 1 (Paper Work):



WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

3 **Mountain to Valley Elevation Difference: A mountain peak is at +4,800 meters and a valley cave is at -200 meters. How much higher is the peak than the cave?**

Way 1 (Paper Work):



CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

4 **Penalty Reversal: A trivia team has -15 points, and then the host removes a -25-point penalty. Write a subtraction expression and find the team's new score.**

Way 1 (Paper Work):



CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

5 **Account Ledger: Your bank account balance is -$12.50. You deposit $30.00 and then spend $8.75 on lunch. What is your new balance?**

Way 1 (Show Paper Steps): Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

6 **Evaluate -5/8 + 3/4.**

Way 1 (Show Paper Steps): Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

7 **Evaluate -2/3 - 5/6.**

Way 1 (Show Paper Steps): Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

8 **Scuba Dive Log: A scuba diver starts at -18.4 meters, rises 7.9 meters, and then descends 5.5 meters. What is the diver's final elevation?**

Way 1 (Show Paper Steps): Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

9 **Cold Front Drop: The temperature drops from +6.5°C in the afternoon to -8.5°C at midnight. What is the signed change in temperature?**

Way 1 (Show Paper Steps): Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

10 **Evaluate -14 - (-20) + (-9) - 5.**

Way 1 (Show Paper Steps): Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

HANDS-ON MODEL: FRACTION STRIPS

Section 10.2 — Practice A: Multiplying and Dividing Rational Numbers

Key Vocabulary: multiplicative sign rules • same signs (positive +) • different signs (negative -) • even/odd negative factors

Name: _____ Date: _____ Score: ____ / 100

TEXTBOOK CONCEPT & HANDS-ON MODEL (FRACTION STRIPS)

Sign Rules for × and ÷

SAME Signs → POSITIVE (+)

(+) × (+) = + | (-) × (-) = +

DIFFERENT Signs → NEGATIVE (-)

(+) × (-) = - | (-) × (+) = -

Multi-Factor & Power Sign Rule

EVEN # of negatives → Positive (+)

Ex: $(-5)^2 = (-5) \times (-5) = +25$

ODD # of negatives → Negative (-)

Ex: $(-2)^3 = (-2)(-2)(-2) = -8$

HOW THE TEXTBOOK & VISUAL MODEL WORK TOGETHER:

Textbook Sign Rules: Same signs → POSITIVE product or quotient (+ · + = +, - · - = +). Different signs → NEGATIVE product or quotient (+ · - = -).

Textbook Multi-Factor Rule: Count the negative factors—an EVEN number of negatives gives a Positive (+); an ODD number of negatives gives a Negative (-).

WATCH OUT: $(-5)^2 = (-5) \times (-5) = +25$ (positive!), whereas -5^2 without parentheses means $-(5 \times 5) = -25$!

WORKED EXAMPLE — 2 TEXTBOOK WAYS FOR DOUBLE POINTS (+20)

Problem: Evaluate 6 × (-4), (-6) × (-4), and $(-5)^2$.

WAY 1: Two-Number Sign Rules (Same = +, Different = -)

6 × (-4) has different signs → -24. (-6) × (-4) has the same signs → +24. $(-5)^2 = (-5) \times (-5)$ has same signs → +25.

WAY 2: Repeated Addition & Factor Sign Count

6 jumps of -4 = -24; taking the opposite for (-6)(-4) gives +24. Count negative signs: 1 negative (odd) → -; 2 negatives (even) → +.

Answer: 6×(-4) = -24, (-6)×(-4) = +24, $(-5)^2$ = +25

CHECK YOUR WORK ON THE SC-6 CALCULATOR — SECTION 10.2 PRACTICE A (SOLVE BY HAND FIRST, THEN VERIFY!)

Worked Example SC-6 Check Keystrokes:

6 [ENTER] 4 [+/-] [×] 5 [+/-] [x^2]

Apply the sign rules (same signs = +, different signs = -) on paper first. Check on your SC-6:

Press 6 [ENTER] 4 [+/-] [×] (-24) and 5 [+/-] [x^2] (+25).

SECTION 10.2 PRACTICE A — KEY IDEAS & MULTI-METHOD PRACTICE

100-PT GOAL: Any 5 in 2 Ways (+20) OR All 10 in 1 Way (+10)!

1 **Evaluate: (a) 7 × (-8) and (b) (-7) × (-8).**

Starter Step 1: Multiply 7 × 8 first; remember that different signs give a NEGATIVE product and same signs give a POSITIVE product.

Way 1 (Paper Work):

Sign Rule: [ ] Same(+) [ ] Diff(-)

Magnitude |a|×|b| = _____

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

2 **Evaluate: (a) -45 ÷ 9 and (b) -45 ÷ (-9).**

Starter Step 1: Divide 45 ÷ 9 first; remember that different signs give a NEGATIVE quotient and same signs give a POSITIVE quotient.

Way 1 (Paper Work):

Sign Rule: [ ] Same(+) [ ] Diff(-)

Magnitude |a|×|b| = _____

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

3 **Evaluate $(-5)^2$. Explain why the result is positive.**

Way 1 (Paper Work):

Sign Rule: [ ] Same(+) [ ] Diff(-)

Magnitude |a|×|b| = _____

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

4 **Evaluate $(-2)^3$. Explain why the cube of a negative number is negative.**

Way 1 (Paper Work):

Sign Rule: [ ] Same(+) [ ] Diff(-)

Magnitude |a|×|b| = _____

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

5 **Evaluate: (-3.5) × (-2.4).**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

6 **Evaluate: -14.4 ÷ 1.2.**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

7 **Evaluate: (-2/3) × (9/10).**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

8 **Evaluate: -5/6 ÷ (-5/12).**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

9 **Evaluate the triple product: (-4) × (-5) × (-6).**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

10 **Evaluate using the Order of Operations: (-18) × 4 - (-36) ÷ (-9).**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

HANDS-ON MODEL: FRACTION STRIPS

Section 10.2 — Practice B: Modeling Real Life (Multiplying and Dividing Rational Numbers)

Textbook Ways: Same/Different Sign Rules | Repeated Addition / Equal Number-Line Jumps Name: _____ Date: _____ Score: ____ / 100

WORKED EXAMPLE — DIVIDING SIGNED RATIONAL NUMBERS (2 TEXTBOOK WAYS = +20 PTS DOUBLE)

Problem: A research submersible descends to -5/6 kilometer at a rate of -5/12 kilometer per minute. How many minutes did the descent take?

WAY 1: Same-Sign Rule + Multiply by the Reciprocal

Negative ÷ Negative = Positive (+). Multiply by the reciprocal: (-5/6) × (-12/5) = +(5 × 12)/(6 × 5) = +12/6 = 2 minutes.

WAY 2: Common Denominator Division (Twelfths)

Rewrite -5/6 as -10/12 km. Divide numerators: (-10 twelfths) ÷ (-5 twelfths/min) = (-10) ÷ (-5) = +2 minutes.

Check: (2 minutes) × (-5/12 km/min) = -10/12 km = -5/6 km.

WATCH OUT: $(-5)^2 = (-5) \times (-5) = +25$ (positive!), whereas -5^2 without parentheses means $-(5 \times 5) = -25$!

Answer: 2 minutes

CHECK YOUR WORK ON THE SC-6 CALCULATOR — SECTION 10.2 PRACTICE B (SOLVE BY HAND FIRST, THEN VERIFY!)

Worked Example SC-6 Check Keystrokes:

[•] [5] [•] [6] [+/−] [ENTER] [•] [5] [•] [1] [2] [+/−] [÷]

Divide (-5/6) ÷ (-5/12) on paper first (negative ÷ negative = positive). Check on your SC-6 with Two-Dot fractions: Press [.] 5 [.] 6 [+/-] [ENTER] [.] 5 [.] 12 [+/-] [÷] to confirm +2 minutes.

Kai had no trouble seeing why 8 seconds of diving at -15 feet per second lands a submarine at -120 feet (8 × -15 = -120), because 8 groups of a 15-foot drop is a 120-foot drop. What bothered him was why a negative times a negative—like (-4) × (-10)—had to be positive (+40). Worse still, he sometimes mixed up adding two negatives (-4 + -10 = -14) with multiplying two negatives! Thinking of (-4) × (-10) as a referee canceling (-4) penalties of -10 points each made the difference click: combining two debts gives a deeper debt (-14), whereas removing 4 ten-point penalties boosts your score by +40.

SECTION 10.2 PRACTICE B — MODELING REAL LIFE & APPLICATIONS

100-PT GOAL: Any 5 in 2 Ways (+20) OR All 10 in 1 Way (+10)!

1 **Submarine Descent Rate: A submarine descends at a constant rate of -15 feet per second for 8 seconds. What is its change in elevation?**

Starter Step 1: Multiply the rate (-15 ft/s) by the time (8 s); since the signs are different, check whether the product is positive or negative.

Way 1 (Paper Work):

Sign Rule: [ ] Same(+) [ ] Diff(-)

Magnitude |a|×|b| = _____

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

2 **Canceling Game Penalties: In a trivia game, each penalty is -10 points. If the referee cancels (-4) penalties of -10 points each, write a multiplication expression to find your score change and explain why it is positive.**

Starter Step 1: Write (-4) × (-10); apply the Same-Signs Rule for multiplying two negative numbers.

Way 1 (Paper Work):

Sign Rule: [ ] Same(+) [ ] Diff(-)

Magnitude |a|×|b| = _____

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

3 **Hourly Temperature Change: Over 6 hours, the temperature changed by a total of -27°F. What was the mean temperature change per hour?**

Way 1 (Paper Work):

Sign Rule: [ ] Same(+) [ ] Diff(-)

Magnitude |a|×|b| = _____

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

4 **Evaluate $(-4)^2$ and $(-4)^3$. Explain why one power is positive and the other is negative.**

Way 1 (Paper Work):

Sign Rule: [ ] Same(+) [ ] Diff(-)

Magnitude |a|×|b| = _____

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

5 **Multiply (-3/4) × (-8/9). Write the product in simplest form.**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

6 **Divide (-7/8) ÷ (7/16). Write the quotient in simplest form.**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

7 **Evaluate (-2.5) × (-1.6) × (-3).**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

8 **Glacier Retreat: A mountain glacier changed in length by -14.4 meters over 4.5 years. What was the average yearly change in length?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

9 **Evaluate (-2) × (-3) × (-4) × (-5).**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

10 **Evaluate $(-6)^2 - 4 \times (-5) + (-18) \div (-3)$.**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

HANDS-ON MODEL: PLACE VALUE BLOCKS

Section 10.3 — Practice A: Solving Two-Step Equations (ax + b = c)

Key Vocabulary: two-step equation (ax + b = c) • reverse order of operations • undo addition/subtraction first • undo multiplication/division second

Name: _____ Date: _____ Score: ____ / 100

TEXTBOOK CONCEPT & HANDS-ON MODEL (PLACE VALUE BLOCKS)

Two-Step Equation Balance Scale: Solve 3x + 7 = 28 in 2 Steps

Step 1: Undo + or - FIRST

Remove 7 loose cubes from both pans:

3x + 7 - 7 = 28 - 7

3x = 21

Step 2: Undo × or ÷ SECOND

Divide 21 cubes equally into 3 x-boxes:

3x ÷ 3 = 21 ÷ 3

x = 7 (Check: 3(7)+7 = 28!)

HOW THE TEXTBOOK & VISUAL MODEL WORK TOGETHER:

Textbook Two-Step Algorithm (ax + b = c): 1. Undo addition or subtraction FIRST to isolate the variable term ax. 2. Undo multiplication or division SECOND to isolate x.

Textbook Verification: Substitute your solution x back into the original two-step equation and follow PEMDAS to confirm Left Side = Right Side.

WATCH OUT: In two-step equations (ax + b = c), undo addition/subtraction FIRST, then undo multiplication/division SECOND!

WORKED EXAMPLE — 2 TEXTBOOK WAYS FOR DOUBLE POINTS (+20)

Problem: Solve 3x + 7 = 28 and check your solution.

WAY 1: Two-Step Inverse Operations (Reverse PEMDAS)

In 3x + 7 = 28: Step 1: Subtract 7 from both sides → 3x = 21. Step 2: Divide both sides by 3 → x = 7.

WAY 2: Balance Scale / Part-Whole Bar Model (With Blocks)

A bar of 28 splits into three x-parts and a 7-part. Take away 7 (leaves 21 for the three x-parts), then divide 21 ÷ 3 = 7.

Answer: x = 7 (Step 1: 3x = 21) 1 Way = +10 | 2 Ways = +20!

CHECK YOUR WORK ON THE SC-6 CALCULATOR — SECTION 10.3 PRACTICE A (SOLVE BY HAND FIRST, THEN VERIFY!)

Worked Example SC-6 Check Keystrokes:

2 8 ENTER 7 - 3 ÷ 2 8 ⇅ 3 × 7 + ≠

Undo + 7 first and × 3 second on paper (x = 7). Check on your SC-6:

Press 28 [ENTER] 7 [-] 3 [÷] (7), then run the Equality Test 28 [ENTER] 3 [ENTER] 7 [×] 7 [+] [≠]—it flashes NO to confirm 3(7) + 7 = 28!

SECTION 10.3 PRACTICE A — KEY IDEAS & MULTI-METHOD PRACTICE

100-PT GOAL: Any 5 in 2 Ways (+20) OR All 10 in 1 Way (+10)!

1 Solve 4x + 9 = 45. Show the result of Step 1 (4x = ?) and the final value of x.

Starter Step 1: Undo + 9 FIRST by subtracting 9 from both sides → Step 2: Undo 4x SECOND by dividing both sides by 4.

Way 1 (Paper Work):

1. Undo +/-: ax = _____

2. Undo ×/÷: x = _____

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

2 Solve 5x - 12 = 38.

Starter Step 1: Undo - 12 FIRST by adding 12 to both sides → Step 2: Undo 5x SECOND by dividing both sides by 5.

Way 1 (Paper Work):

1. Undo +/-: ax = _____

2. Undo ×/÷: x = _____

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

3 Solve 6y + 11 = 59.

Way 1 (Paper Work):

1. Undo +/-: ax = _____

2. Undo ×/÷: x = _____

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

4 Solve 8n - 15 = 49.

Way 1 (Paper Work):

1. Undo +/-: ax = _____

2. Undo ×/÷: x = _____

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

5 Solve m ÷ 4 + 6 = 15.

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

6 Solve k ÷ 3 - 5 = 7.

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

7 Solve -3x + 14 = 2.

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

8 Solve 2.5w + 8 = 23.

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

9 Appliance Repair Call: A repair technician charges a $35 service visit fee plus $25 per hour of labor. If the total bill is $160, write and solve a two-step equation to find how many hours h the technician worked.

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

10 Skateboard Savings Plan: You already have $45 saved toward a $120 custom skateboard and save $15 each week. Write and solve a two-step equation to find how many weeks w it will take to reach $120.

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) Ans: _____

HANDS-ON MODEL: PLACE VALUE BLOCKS

Section 10.3 — Practice B: Modeling Real Life (Solving Two-Step Equations (ax + b = c))

Textbook Ways: Two-Step Inverse Operations | Balance Scale / Bar Model Unwrapping Name: _____ Date: _____ Score: ____ / 100

WORKED EXAMPLE — TWO-STEP EQUATION WITH A NEGATIVE RATE (2 TEXTBOOK WAYS = +20 PTS DOUBLE)

Problem: The temperature is 14°F and drops 3°F each hour. After how many hours will the temperature reach 2°F?

WAY 1: Write & Solve -3x + 14 = 2 Using Inverse Operations

Step 1: Subtract 14 from both sides: -3x = 2 - 14 = -12. Step 2: Divide both sides by -3: x = (-12) ÷ (-3) = 4 hours.

WAY 2: Total Change ÷ Rate of Change (or Countdown Table)

Total drop = 14°F to 2°F = 12°F drop. At 3°F per hour, 12 ÷ 3 = 4 hours (14° → 11° → 8° → 5° → 2°).

Check: -3(4) + 14 = -12 + 14 = 2°F.

WATCH OUT: In two-step equations (ax + b = c), undo addition/subtraction FIRST, then undo multiplication/division SECOND!

Answer: 4 hours

CHECK YOUR WORK ON THE SC-6 CALCULATOR — SECTION 10.3 PRACTICE B (SOLVE BY HAND FIRST, THEN VERIFY!)

Worked Example SC-6 Check Keystrokes:

2 ENTER 1 4 - 3 +/− ÷ 2 ↑↓ 3 +/− × 1 4 + ≠

Subtract 14 first, then divide by -3 on paper (h = 4). Check on your SC-6:
Press 2 [ENTER] 14 [-] 3 [+/-] [÷] (4), then test 2 [ENTER] 14 [ENTER] 3 [ENTER] 4 [×] [-] [≠]—it flashes NO to confirm 14 - 3(4) = 2!

At the go-kart track, admission was $8 plus $6 per lap r, and Leo had $38 to spend (6r + 8 = 38). At first he tried dividing 38 by 6 right away, got a messy fraction, and felt stuck. Then Maya reminded him of how you get dressed in the morning versus how you undress at night: you put your socks on first and your shoes on second, so to undo it you have to take your shoes off FIRST and your socks off SECOND! In 6r + 8 = 38, r was multiplied by $6 first and $8 was added second—so subtracting the $8 admission fee first (6r = 30) and dividing by $6 second gave a clean 5 laps.

SECTION 10.3 PRACTICE B — MODELING REAL LIFE & APPLICATIONS

100-PT GOAL: Any 5 in 2 Ways (+20) OR All 10 in 1 Way (+10)!

1 **Go-Kart Track: Admission to a go-kart track is $8 plus $6 for each lap r. If you spend $38 in all, how many laps did you drive?**

Starter Step 1: Write 6r + 8 = 38 → Step 1: Subtract the $8 admission from both sides first → Step 2: Divide by $6 per lap.

Way 1 (Paper Work):

1. Undo +/-: ax = _____
2. Undo ×/÷: x = _____

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

2 **3D Print Shop Quote: A print shop charges a $12 setup fee plus $4 per hour h of printing. If your total bill is $48, how many hours did the print take?**

Starter Step 1: Write 4h + 12 = 48 → Step 1: Subtract the $12 setup fee from both sides first → Step 2: Divide by $4 per hour.

Way 1 (Paper Work):

1. Undo +/-: ax = _____
2. Undo ×/÷: x = _____

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

3 **Bicycle Savings Plan: You have $35 saved and save $15 per week w to buy a $140 bicycle. How many weeks will it take to save enough money?**

Way 1 (Paper Work):

1. Undo +/-: ax = _____
2. Undo ×/÷: x = _____

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

4 **Bookstore Gift Card: You buy 4 identical hardcover books and use a $10 gift card, paying $46 out of pocket. What was the price b of each book?**

Way 1 (Paper Work):

1. Undo +/-: ax = _____
2. Undo ×/÷: x = _____

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

5 **Solve -4x + 18 = -6, and check your solution.**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

6 **Solve (n ÷ 5) + 9 = 16, and check your solution.**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

7 **Scuba Tank Pressure: A scuba air tank starts at 3,000 psi and uses 40 psi per minute m until 600 psi remains. How many minutes did the dive last?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

8 **Solve (2/3)x - 5 = 11, and check your solution.**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

9 **Rectangle Perimeter: A rectangle has a length of 18 cm and a perimeter of 56 cm. Write and solve an equation to find its width w.**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

10 **Taxi Fare: A taxi ride costs a $3.50 base fare plus $2.25 per mile m. If the total fare is $21.50, how many miles was the ride?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

TEXTBOOK MODEL: PAPER / GRAPH / FORMULA

Section 10.4 — Practice A: Theoretical Probability, Combinations & Permutations

Key Vocabulary: experiment • outcomes • event • sample space • theoretical probability P(E) • complement P(not E) • tree diagram • Fundamental Counting Principle

Name: _____ Date: _____ Score: ____ / 100

TEXTBOOK CONCEPT & VISUAL DIAGRAM

Probability Ratio



P(Blue) = 4/10 = 2/5 = 40%

P(not E) = 1 - P(E)

P(E) = Favorable ÷ Total

Counting: Permutations vs. Combinations

Permutation (nPr) — Order MATTERS!

1st/2nd/3rd of 10: 10 × 9 × 8 = 720

Combination (nCr) — Order Does NOT Matter!

3-person group of 10: 720 ÷ 3! = 120

HOW THE TEXTBOOK & VISUAL MODEL WORK TOGETHER:

Textbook Theoretical Probability: P(event) = Favorable Outcomes ÷ Total Outcomes (from 0 to 1, or 0% to 100%), and P(not E) = 1 - P(E).

Textbook Counting & Permutations vs. Combinations: Fundamental Counting Principle multiplies choices; Permutations nPr (order matters) vs. Combinations nCr (order doesn't matter).

WATCH OUT: Ask 'Does order matter?' — awarding 1st/2nd/3rd medals is a Permutation (nPr); choosing a group/team is a Combination (nCr)!

WORKED EXAMPLE — 3 TEXTBOOK WAYS (ANY 2 WAYS = +20 PTS)

Problem: A 10-sector spinner has 4 Blue, 3 Gold, and 3 Red sectors. Find P(Blue) as a fraction, decimal, and percent, and find how many ways 5 trophies can be arranged in a row (5!).

WAY 1: Theoretical Probability Ratio P(E) = Favorable / Total

Spinner (4 Blue, 3 Gold, 3 Red = 10 sectors): P(Blue) = 4/10 = 2/5 = 40%. P(not Blue) = (3 + 3)/10 = 6/10 = 3/5 = 60%.

WAY 2: Complement Rule P(not E) = 1 - P(E)

Subtract P(Blue) from 1 whole (100%): P(not Blue) = 1 - 2/5 = 3/5 (or 100% - 40% = 60%).

WAY 3: Fundamental Counting Principle (5 Trophies in a Row)

Multiply choices for each spot: 5 choices for 1st × 4 for 2nd × 3 for 3rd × 2 for 4th × 1 for 5th = 120 arrangements.

Answer: P(Blue) = 2/5 = 0.4 = 40%; 5! = 120 ways

CHECK YOUR WORK ON THE SC-6 CALCULATOR — SECTION 10.4 PRACTICE A (SOLVE BY HAND FIRST, THEN VERIFY!)

Worked Example SC-6 Check Keystrokes:

[•] [4] [•] [1] [0] [g] [SIMP] [5] [x!]

Write P(event) = favorable / total and simplify on paper first. Check on your SC-6: Press [.] 4 [.] 10 [g][SIMP] to confirm 2/5, press 5 [x!] to confirm 5! = 120, and explore rolls with [DICE] or [f][1..x]!

SECTION 10.4 PRACTICE A — KEY IDEAS & MULTI-METHOD PRACTICE

100-PT GOAL: Any 5 in 2 Ways (+20) OR All 10 in 1 Way (+10)!

1 Not Rolling a Six: You roll a fair 6-sided die once. What is the probability of rolling a 5, and what is the probability of NOT rolling a 6?

Starter Step 1: A fair die has 6 equally likely outcomes: count how many outcomes are favorable for P(5) and for P(not 6).

Way 1 (Paper Work):

P(E) = Favorable ___ / Total ___

Simp = ___/___ = _____%

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

2 Complementary Weather Probability: A weather forecast states there is a 0.35 (35%) probability of rain today. What is the probability that it will NOT rain today?

Starter Step 1: An event and its complement always add to 1 whole (1.00): subtract 0.35 from 1.00 to find P(no rain).

Way 1 (Paper Work):

P(E) = Favorable ___ / Total ___

Simp = ___/___ = _____%

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

3 Double Sixes & High Sums: You roll two fair 6-sided dice (36 equally likely outcomes). What is the probability of rolling double sixes (6, 6), and what is the probability of rolling a sum of 11 or 12?

Way 1 (Paper Work):

P(E) = Favorable ___ / Total ___

Simp = ___/___ = _____%

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

4 Bookshelf Lineup: In how many different left-to-right orders can 4 different books be arranged on a shelf?

Way 1 (Paper Work):

P(E) = Favorable ___ / Total ___

Simp = ___/___ = _____%

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

5 Track Finals: Six runners are in the finals of the 100-meter dash. In how many different orders can the 6 runners finish 1st through 6th?

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

6 How many different 3-person project teams can be chosen from 8 students when order does NOT matter?

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

7 How many different ways can 1st, 2nd, and 3rd place ribbons be awarded among 8 science fair finalists when order DOES matter?

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

8 Triple Coin Toss: You flip a fair coin 3 times in a row. What is the probability of getting Heads on all 3 flips, written as a fraction and as a percent?

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

9 Consecutive Matching Socks: A drawer contains 6 blue socks and 4 gray socks (10 socks total). If you pull out 2 socks in a row without replacement, what is the probability that both socks are blue?

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

10 Committee vs. Officers: Compare choosing a 3-person cleanup team from 10 students (where order does not matter) vs. electing a President, Vice President, and Secretary from 10 students (where order matters).

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

TEXTBOOK MODEL: PAPER / GRAPH / FORMULA

Section 10.4 — Practice B: Modeling Real Life (Theoretical Probability, Combinations & Permutations)

Textbook Ways: Probability Ratio & Complement Rule | Tree Diagram / Outcome List | Fundamental Counting Principle

Name: _____ Date: _____ Score: _____ / 100

WORKED EXAMPLE — ORDERED ARRANGEMENTS VS. UNORDERED GROUPS (2 TEXTBOOK WAYS = +20 PTS DOUBLE)

Problem: Compare awarding 1st, 2nd, and 3rd place ribbons to 10 runners (order matters) with choosing a 3-person relay crew from 10 runners (order does not matter).

WAY 1: Fundamental Counting Principle (Order Matters)

For 1st, 2nd, and 3rd place ribbons, multiply choices: 10 choices for 1st × 9 for 2nd × 8 for 3rd = 720 ordered ways.

WAY 2: Divide Out Duplicate Orders When Order Does Not Matter

Any 3 chosen runners can be arranged in 3 × 2 × 1 = 6 orders. Divide 720 ordered ways by 6: 720 ÷ 6 = 120 relay crews.

Rule: Order matters → Permutation (720); Order does not matter → Combination (720 ÷ 6 = 120).

WATCH OUT: Ask 'Does order matter?' — awarding 1st/2nd/3rd medals is a Permutation (nPr); choosing a group/team is a Combination (nCr)!

Answer: 720 ordered podiums; 120 unordered 3-runner crews

CHECK YOUR WORK ON THE SC-6 CALCULATOR — SECTION 10.4 PRACTICE B (SOLVE BY HAND FIRST, THEN VERIFY!)

Worked Example SC-6 Check Keystrokes:

1 0 ENTER 3 f $_nC_r$ 1 0 ENTER 3 g $_nP_r$

Decide whether order matters first! Then check on your SC-6:
Press 10 [ENTER] 3 [g][nPr] to confirm 720 ordered podiums (permutations), and 10 [ENTER] 3 [f][nCr] to confirm 120 unordered crews (combinations)!

When Maya's coach needed to pick 3 players from 7 teammates, Maya couldn't understand why picking a 1st, 2nd, and 3rd place batting order had 210 possibilities while picking a 3-person cleanup crew from the same 7 kids had only 35! She wrote out three players—Ali, Ben, and Cam—and suddenly saw why: in a batting order, Ali-Ben-Cam and Ben-Ali-Cam are different lineups (6 different orders for the same 3 kids!), whereas on a cleanup crew, Ali, Ben, and Cam are the exact same group of 3 people no matter whose name is called first. Dividing 210 by those 6 duplicate orders (3! = 6) explained why combinations (35) are six times smaller than permutations (210).

SECTION 10.4 PRACTICE B — MODELING REAL LIFE & APPLICATIONS

100-PT GOAL: Any 5 in 2 Ways (+20) OR All 10 in 1 Way (+10)!

1 **20-Sided Die: You roll a fair 20-sided die numbered 1 to 20. What is the theoretical probability of rolling a multiple of 5? Write your answer as a simplified fraction, a decimal, and a percent.**

Starter Step 1: List the multiples of 5 from 1 to 20 to count favorable outcomes, then divide by the 20 total outcomes and simplify.

Way 1 (Paper Work):

P(E) = Favorable ___ / Total ___

Simp = ___/___ = _____%

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

2 **Complementary Event: The weather forecast says there is a 35% chance of rain tomorrow. What is the probability that it does not rain tomorrow?**

Starter Step 1: Rain and no rain are complementary events that add to 100%: subtract 35% from 100%.

Way 1 (Paper Work):

P(E) = Favorable ___ / Total ___

Simp = ___/___ = _____%

WARM-UP • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

3 **Kea Parrot Token Jar: Researchers show a kea parrot a jar containing 6 black (reward) tokens, 5 green tokens, and 4 white tokens. What is P(black) and what is P(not white) in simplest form?**

Way 1 (Paper Work):

P(E) = Favorable ___ / Total ___

Simp = ___/___ = _____%

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

4 **Custom Skateboard Choices: A skate shop offers 5 deck designs, 4 truck colors, and 6 wheel sets. How many different custom skateboard combinations are possible?**

Way 1 (Paper Work):

P(E) = Favorable ___ / Total ___

Simp = ___/___ = _____%

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

5 **Playlist Shuffle: You put 5 songs on a playlist. In how many different orders can all 5 songs be played without repeating?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

6 **Batting Order: A softball coach chooses 3 players from a group of 7 to bat 1st, 2nd, and 3rd. How many different 3-batter orders are possible?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

7 **Science Lab Trio: A teacher chooses a group of 3 lab partners from 7 students. Since order does not matter, how many different 3-student groups are possible?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

8 **Smoothie Two-Fruit Blend: A smoothie shop has 8 kinds of fruit, and you pick 2 different fruits to blend together. How many 2-fruit combinations can you choose?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CORE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

9 **Expected Outcomes: A game spinner lands on gold 3/8 of the time. If you spin it 160 times, how many times should you expect it to land on gold?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

10 **Coin & Die Compound Event: You flip a fair coin and roll a fair 6-sided die. How many outcomes are in the sample space, and what is the probability of getting Heads and a 6?**

Way 1 (Show Paper Steps):

Way 2 (2nd Method / Check):

CHALLENGE • [ ] +10 (1 Way) [ ] +20 (2 Ways) **Ans:** _____

SUMMATIVE QUIZ: 10 ITEMS × 10 PTS = 100

Unit 10 Mastery Quiz: Grade 7 Bridge — Signed Rationals, 2-Step Equations & Probability

Directions: Show all paper steps in each box (+6 pts work, +4 pts answer). Name: _____ Date: _____ Score: ____ / 100

ASSESSMENT BREAKDOWN: #1–#6 CORE FLUENCY (60 PTS) • #7–#9 REAL-LIFE APPLICATIONS (30 PTS) • #10 ERROR ANALYSIS (10 PTS)

Standards Assessed: CCSS 7.NS.A, 7.EE.B.4, 7.SP.C • TEKS 6.3D, 7.11A, 7.6I • FL MA.7.NSO.2, MA.7.AR.2, MA.7.DP.2 • MathCounts & UIL Signed Arithmetic, 2-Step Equations & Probability

1 CORE FLUENCY (SEC 10.1) • 10 PTS

Evaluate the signed expressions: (a) $-9 + 14$ (b) $-6 - (-15)$.

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

2 CORE FLUENCY (SEC 10.2) • 10 PTS

Evaluate the signed products and powers: (a) $(-7) \times (-8)$ (b) $(-5)^2$.

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

3 CORE FLUENCY (SEC 10.2) • 10 PTS

Evaluate using order of operations: $(-48) \div 6 + (-3) \times (-4)$.

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

4 CORE FLUENCY (SEC 10.3) • 10 PTS

Solve the two-step equation: $3x - 7 = 20$.

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

5 CORE FLUENCY (SEC 10.3) • 10 PTS

Solve the two-step equation: $(x / 4) + 5 = 11$.

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

6 CORE FLUENCY (SEC 10.4) • 10 PTS

A bag holds 5 red, 3 blue, and 4 green marbles. Find the probability of drawing a blue marble in simplest form.

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

7 REAL LIFE (SEC 10.1) • 10 PTS

A scuba diver starts at -18 meters, descends 12 meters, and then ascends 9 meters. What is the diver's final elevation?

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

8 REAL LIFE (SEC 10.3) • 10 PTS

A kayak rental costs a $15 safety fee plus $12 per hour h. If a family paid $63 total, how many hours did they rent the kayak?

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

9 REAL LIFE (SEC 10.4) • 10 PTS

You flip a fair coin and roll a standard 6-sided die. What is the compound probability of getting Heads AND a number greater than 4?

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

10 ERROR ANALYSIS (SEC 10.3) • 10 PTS

To solve $2x + 6 = 18$, Ava divided 18 by 2 first to get $x + 6 = 9$, then subtracted 6 to get $x = 3$. Check $x = 3$ and solve correctly.

[ ] Work (+6) [ ] Ans (+4) **Ans:** _____

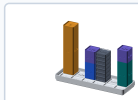
Unit 10: Grade 7 Bridge — Signed Rationals, 2-Step Equations & Probability — Practice A & B Complete Key

Big Ideas Math Grade 7 Bridge — Chapters 1–3 & Chapter 7 • Concept → Blocks (When Applicable: Place Value, Fraction & Prime Blocks) → Calculator

1. Concept (Stack Approach): Two-step equations unwrap in reverse order of operations (undo ±b first, then ÷a second), and squaring a negative in X ([+/-][x²]) squares the entire signed value.

2. Blocks (Place Value, Fraction & Prime): Model zero pairs and 2-step balance with Place Value blocks and probability part-to-whole ratios with Fraction Strips.

3. Calculator (SC-6): Verify signed powers (5 [+/-][x²] = +25), check 2-step equations with [≠], and evaluate factorials [x!], combinations [f][nCr], and permutations [g][nPr].



SEC 10.1 (pp.95-96): ADDING AND SUBTRACTING RATIONAL NUMBERS

Methods: W1: Zero-Pair Cancellation | W2: Number-Line Jumps | W3: Absolute Value Sign Rules & Add-the-Opposite

PRACTICE A (p.95): KEY IDEAS (#1-#10)

ExA: -8 + 5 = -3; -6 + (-4) = -10

A1: (a) -6; (b) -24 (-15 + 9; -15 + -9)
Check: 15 [+/-] [ENT] 9 [+] / 15 [+/-] [ENT] 9 [+/-] [+]

A2: -9 (14 + -23)
Check: 14 [ENT] 23 [+/-] [+]

A3: (a) 30; (b) -4 (12 - -18; -12 - -8)
Check: 12 [ENT] 18 [+/-] [-] / 12 [+/-] [ENT] 8 [+/-] [-]

A4: -25 (-9 - 16)
Check: 9 [+/-] [ENT] 16 [-]

A5: -14.2°C ((0 - 7.8) - 6.4)
Check: 0 [ENT] 7.8 [-] 6.4 [-]

A6: -4.8 (6.4 - 11.2)
Check: 6.4 [ENT] 11.2 [-]

A7: +2.7 (-7.5 - -10.2)
Check: 7.5 [+/-] [ENT] 10.2 [+/-] [-]

A8: -1/8 (-3/4 - -5/8)
Check: [.] 3 [.] 4 [+/-] [ENT] [.] 5 [.] 8 [+/-] [-]

A9: 36°F (14 - -22)
Check: 14 [ENT] 22 [+/-] [-]

A10: 2 7/8 (2.875) ((-2.5 + 4.25) + 1.125)
Check: 2.5 [+/-] [ENT] 4.25 [+] 1.125 [+]

PRACTICE B (p.96): REAL LIFE (#1-#10)

ExB: 14°C; and -1/8

B1: +8°F (-14 + 22)
Check: 14 [+/-] [ENT] 22 [+]

B2: -83 meters (-45 + -38)
Check: 45 [+/-] [ENT] 38 [+/-] [+]

B3: 4,800 - (-200) = 5,000 meters (4800 - -200)
Check: 4800 [ENT] 200 [+/-] [-]

B4: -15 - (-25) = +10 points (-15 - -25)
Check: 15 [+/-] [ENT] 25 [+/-] [-]

B5: +$8.75 ((-12.50 + 30) - 8.75)
Check: 12.50 [+/-] [ENT] 30 [+] 8.75 [-]

B6: 1/8 (-5/8 + 3/4)
Check: [.] 5 [.] 8 [+/-] [ENT] [.] 3 [.] 4 [+]

B7: -9/6 = -1 1/2 (-2/3 - 5/6)
Check: [.] 2 [.] 3 [+/-] [ENT] [.] 5 [.] 6 [-]

B8: -16.0 meters ((-18.4 + 7.9) - 5.5)
Check: 18.4 [+/-] [ENT] 7.9 [+] 5.5 [-]

B9: -15.0°C (-8.5 - 6.5)
Check: 8.5 [+/-] [ENT] 6.5 [-]

B10: -8 (((-14 - -20) + -9) - 5)
Check: 14 [+/-] [ENT] 20 [+/-] [-] 9 [+/-] [+] 5 [-]

SEC 10.2 (pp.97-98): MULTIPLYING AND DIVIDING RATIONAL NUMBERS

Methods: W1: Same/Different Sign Rules | W2: Repeated Addition / Equal Number-Line Jumps

PRACTICE A (p.97): KEY IDEAS (#1-#10)

ExA: 6×(-4) = -24, (-6)×(-4) = +24, (-5)² = +25

A1: (a) -56; (b) +56 (7 × -8; -7 × -8)
Check: 7 [ENT] 8 [+/-] [×] / 7 [+/-] [ENT] 8 [+/-] [×]

A2: (a) -5; (b) +5 (-45 ÷ 9; -45 ÷ -9)
Check: 45 [+/-] [ENT] 9 [÷] / 45 [+/-] [ENT] 9 [+/-] [÷]

A3: +25 (2 negative factors = positive) (-5²)
Check: 5 [+/-] [x²]

A4: -8 (3 negative factors = odd count = negative) (-2³)
Check: 2 [+/-] [x³]

A5: +8.4 (-3.5 × -2.4)
Check: 3.5 [+/-] [ENT] 2.4 [+/-] [×]

A6: -12 (-14.4 ÷ 1.2)
Check: 14.4 [+/-] [ENT] 1.2 [÷]

A7: -3/5 (-0.6) (-2/3 × 9/10)
Check: [.] 2 [.] 3 [+/-] [ENT] [.] 9 [.] 10 [×]

A8: +2 (-5/6 ÷ -5/12)
Check: [.] 5 [.] 6 [+/-] [ENT] [.] 5 [.] 12 [+/-] [÷]

A9: -120 ((-4 × -5) × -6)
Check: 4 [+/-] [ENT] 5 [+/-] [×] 6 [+/-] [×]

A10: -76 ((-18 × 4) - (-36 ÷ -9))
Check: 18 [+/-] [ENT] 4 [×] 36 [+/-] [ENT] 9 [+/-] [÷] [-]

PRACTICE B (p.98): REAL LIFE (#1-#10)

ExB: 2 minutes

B1: -120 feet (8 × -15)
Check: 8 [ENT] 15 [+/-] [×]

B2: +40 points (same signs give a positive product) (-4 × -10)
Check: 4 [+/-] [ENT] 10 [+/-] [×]

B3: -4.5°F per hour (-27 ÷ 6)
Check: 27 [+/-] [ENT] 6 [÷]

B4: (-4)² = +16; (-4)³ = -64 (-4³)
Check: 4 [+/-] [x²] 4 [+/-] [x³]

B5: +2/3 (-3/4 × -8/9)
Check: [.] 3 [.] 4 [+/-] [ENT] [.] 8 [.] 9 [+/-] [×]

B6: -2 (-7/8 ÷ 7/16)
Check: [.] 7 [.] 8 [+/-] [ENT] [.] 7 [.] 16 [÷]

B7: -12 ((-2.5 × -1.6) × -3)
Check: 2.5 [+/-] [ENT] 1.6 [+/-] [×] 3 [+/-] [×]

B8: -3.2 meters per year (-14.4 ÷ 4.5)
Check: 14.4 [+/-] [ENT] 4.5 [÷]

B9: +120 (((-2 × -3) × -4) × -5)
Check: 2 [+/-] [ENT] 3 [+/-] [×] 4 [+/-] [×] 5 [+/-] [×]

B10: 36 - (-20) + 6 = 62 ((-6² - (4 × -5)) + (-18 ÷ -3))
Check: 6 [+/-] [x²] 4 [ENT] 5 [+/-] [×] [-] 18 [+/-] [ENT] 3 [+/-] [÷] [+]

SEC 10.3 (pp.99-100): SOLVING TWO-STEP EQUATIONS (AX + B = C)

Methods: W1: Two-Step Inverse Operations | W2: Balance Scale / Bar Model Unwrapping

PRACTICE A (p.99): KEY IDEAS (#1-#10)

ExA: x = 7 (Step 1: 3x = 21)

A1: 4x = 36; x = 9 ((45 - 9) ÷ 4)
Check: 45 [ENT] 9 [-] 4 [÷]

A2: 5x = 50; x = 10 ((38 + 12) ÷ 5)
Check: 38 [ENT] 12 [+] 5 [÷]

A3: 6y = 48; y = 8 ((59 - 11) ÷ 6)
Check: 59 [ENT] 11 [-] 6 [÷]

A4: 8n = 64; n = 8 ((49 + 15) ÷ 8)
Check: 49 [ENT] 15 [+] 8 [÷]

A5: m / 4 = 9; m = 36 ((15 - 6) × 4)
Check: 15 [ENT] 6 [-] 4 [×]

A6: k / 3 = 12; k = 36 ((7 + 5) × 3)
Check: 7 [ENT] 5 [+] 3 [×]

A7: -3x = -12; x = 4 ((2 - 14) ÷ -3)
Check: 2 [ENT] 14 [-] 3 [+/-] [÷]

A8: 2.5w = 15; w = 6 ((23 - 8) ÷ 2.5)
Check: 23 [ENT] 8 [-] 2.5 [÷]

A9: 25h + 35 = 160; h = 5 hours ((160 - 35) ÷ 25)
Check: 160 [ENT] 35 [-] 25 [÷]

A10: 15w + 45 = 120; w = 5 weeks ((120 - 45) ÷ 15)
Check: 120 [ENT] 45 [-] 15 [÷]

PRACTICE B (p.100): REAL LIFE (#1-#10)

ExB: 4 hours

B1: 6r + 8 = 38 → r = 5 laps ((38 - 8) ÷ 6)
Check: 38 [ENT] 8 [-] 6 [÷]

B2: 4h + 12 = 48 → h = 9 hours ((48 - 12) ÷ 4)
Check: 48 [ENT] 12 [-] 4 [÷]

B3: 15w + 35 = 140 → w = 7 weeks ((140 - 35) ÷ 15)
Check: 140 [ENT] 35 [-] 15 [÷]

B4: 4b - 10 = 46 → b = $14 per book ((46 + 10) ÷ 4)
Check: 46 [ENT] 10 [+] 4 [÷]

B5: x = 6 (-4·6 + 18 = -6) ((-6 - 18) ÷ -4)
Check: 6 [+/-] [ENT] 18 [-] 4 [+/-] [÷]

B6: n = 35 ((16 - 9) × 5)
Check: 16 [ENT] 9 [-] 5 [×]

B7: 3000 - 40m = 600 → m = 60 minutes ((600 - 3000) ÷ -40)
Check: 600 [ENT] 3000 [-] 40 [+/-] [÷]

B8: x = 24 ((11 + 5) ÷ 2/3)
Check: 11 [ENT] 5 [+] [.] 2 [.] 3 [÷]

B9: 2w + 36 = 56 → w = 10 cm ((56 - 36) ÷ 2)
Check: 56 [ENT] 36 [-] 2 [÷]

B10: 2.25m + 3.50 = 21.50 → m = 8 miles ((21.50 - 3.50) ÷ 2.25)
Check: 21.50 [ENT] 3.50 [-] 2.25 [÷]

SEC 10.4 (pp.101-102): THEORETICAL PROBABILITY, COMBINATIONS & PERMUTATIONS

Methods: W1: Probability Ratio & Complement Rule | W2: Tree Diagram / Outcome List | W3: Fundamental Counting Principle

PRACTICE A (p.101): KEY IDEAS (#1-#10)

ExA: P(Blue) = 2/5 = 0.4 = 40%; 5! = 120 ways

A1: P(5) = 1/6; P(not 6) = 5/6 (1/6; and 1 - 1/6 = 5/6)
Check: Mental / Table Check

A2: 0.65 (65% or 13/20) (1 - 0.35)
Check: 1 [ENT] 0.35 [-]

A3: P(double 6s) = 1/36; P(sum 11 or 12) = 3/36 = 1/12
Check: Mental / Table Check

A4: 24 ways (4!)
Check: 4 [x!]

A5: 720 ways (6!)
Check: 6 [x!]

A6: 56 teams (C(8,3))
Check: 8 [ENT] 3 [f][nCr]

A7: 336 podium arrangements (P(8,3))
Check: 8 [ENT] 3 [g][nPr]

A8: 1/8 (12.5%) (1/2 × 1/2 × 1/2 = 1/8)
Check: Mental / Table Check

A9: 1/3 (6/10 × 5/9 = 30/90) (6/10 × 5/9 = 30/90)
Check: Mental / Table Check

A10: 120 combinations vs. 720 permutations (differ by 3! = 6)
Check: 10 [ENT] 3 [f][nCr] / [g][nPr]

PRACTICE B (p.102): REAL LIFE (#1-#10)

ExB: 720 ordered podiums; 120 unordered 3-runner crews

B1: 4/20 = 1/5 = 0.20 = 20% (Simp(4/20))
Check: [.] 4 [.] 20 [g][SIMP] [FDISP]

B2: 65% (13/20 = 0.65) (100 - 35)
Check: 100 [ENT] 35 [-]

B3: P(black) = 2/5; P(not white) = 11/15 (Simp(6/15))
Check: [.] 6 [.] 15 [g][SIMP]

B4: 120 custom skateboards ((5 × 4) × 6)
Check: 5 [ENT] 4 [×] 6 [×]

B5: 5! = 120 orders (5!)
Check: 5 [x!]

B6: 210 batting orders (permutations) (P(7,3))
Check: 7 [ENT] 3 [g][nPr]

B7: 35 lab groups (combinations) (C(7,3))
Check: 7 [ENT] 3 [f][nCr]

B8: 28 fruit combinations (C(8,2))
Check: 8 [ENT] 2 [f][nCr]

B9: 60 times (160 × 3/8)
Check: 160 [ENT] [.] 3 [.] 8 [×]

B10: 12 outcomes; P(H and 6) = 1/12 (2 × 6)
Check: 2 [ENT] 6 [×]

UNIT 10 MASTERY QUIZ KEY (p.121 • TEKS 6.3D, 7.11A, 7.6I): Q1: (a) 5 (b) 9 Q2: (a) 56 (b) 25 Q3: 4 Q4: x = 9 Q5: x = 24

Quiz Q6–Q10 Answers: Q6: 1/4 Q7: -21 m Q8: 4 hours Q9: 1/6 Q10: 2(3)+6=12≠18; x = 6