Multiplying Integers and Rational Numbers

Apply the skill to decisions and designs

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

Equal signs give a positive product; different signs give a negative product. Multiply fraction numerators and denominators, then reduce: $(-2/3)(9/4) = -18/12 = -3/2$. Zero times any number is zero.

Worked example

Evaluate $(-\frac{3}{2}) \times (\frac{1}{2})$. Show an exact fraction or integer.

1. The sign is negative because the factors have different signs.

2. Multiply numerator and denominator: $\frac{(-3)(1)}{2(2)} = \frac{-3}{4}$.

3. Reduce to $-\frac{3}{4}$; check $-\frac{3}{4} \div (\frac{1}{2}) = -\frac{3}{2}$.

Answer: $-\frac{3}{4}$.

Practice Problems

Show your thinking.

1. Weather station: a signed model gives $(-\frac{7}{2}) \times (1)$ meters. Find the signed result and interpret a negative result as below the reference level.

2. Balance log: plan A changes a balance by $(\frac{5}{3}) \times (-\frac{9}{4})$ dollars; plan B changes it by $-\frac{23}{4}$ dollars. Which leaves a larger balance from the same start, and by how much?

3. Sensor calibration: an unknown first reading combined with (-1) by the operation $\times$ gives $\frac{3}{2}$. Recover the first reading.

4. Target design: choose x so that $[(4) \times (-\frac{4}{3})] + x = -\frac{7}{3}$. Determine x and verify the target.

5. Spending plan: the signed change is $(-1) \times (\frac{7}{4})$ dollars. Starting at $\frac{47}{4}$ dollars, find the final balance.

6. Snow-depth log: one day's signed change is $(1) \times (-3)$ cm. Find the total change over 3 identical days.

7. Water record: a signed volume change is $(-4) \times (\frac{5}{3})$ liters. Compare with a target change of $-\frac{17}{3}$ liters and find the gap.

8. Elevation log: two readings are 0 and $(3) \times (-\frac{3}{4})$ meters. Find the second reading and its distance from zero.

9. Freezer log: plan A changes a balance by $(-\frac{17}{5}) \times (\frac{11}{6})$ dollars; plan B changes it by $-\frac{247}{30}$ dollars. Which leaves a larger balance from the same start, and by how much?

10. Credit adjustment: choose x so that $[(\frac{19}{8}) \times (-\frac{7}{12})] + x = \frac{155}{96}$. Determine x and verify the target.

Answer Key

1. $-\frac{7}{2}$ meters; below the reference level.
2. Plan A by 2 dollars.
3. $-\frac{3}{2}$.
4. $x = 3$.
5. 10 dollars.
6. -9 cm.
7. Signed change $-\frac{20}{3}$ liters; 1 liter below target.
8. Reading $-\frac{9}{4}$ m; distance $\frac{9}{4}$ m.
9. Plan A by 2 dollars.
10. $x = 3$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(-7)(1)}{2(1)} = \frac{-7}{2}$.
3. Reduce to $-\frac{7}{2}$; check $-\frac{7}{2} \div (1) = -\frac{7}{2}$.

Problem 2

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(5)(-9)}{3(4)} = \frac{-45}{12}$.
3. Reduce to $-\frac{15}{4}$; check $-\frac{15}{4} \div (-\frac{9}{4}) = \frac{5}{3}$.
4. $-\frac{15}{4} - (-\frac{23}{4}) = 2$ dollars.

Problem 3

1. Divide the product by the known factor.
2. Reciprocal of the divisor: $1/(-1) = -1$.
3. $x = (\frac{3}{2}) \div (-1) = -\frac{3}{2}$.
4. Check in the original: $(-\frac{3}{2}) \times (-1) = \frac{3}{2}$.

Problem 4

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(4)(-4)}{1(3)} = \frac{-16}{3}$.
3. Reduce to $-\frac{16}{3}$; check $-\frac{16}{3} \div (-\frac{4}{3}) = 4$.
4. $x = -\frac{7}{3} - (-\frac{16}{3}) = 3$; check $-\frac{16}{3} + 3 = -\frac{7}{3}$.

Problem 5

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(-1)(7)}{1(4)} = \frac{-7}{4}$.
3. Reduce to $-\frac{7}{4}$; check $-\frac{7}{4} \div (\frac{7}{4}) = -1$.
4. Final $= \frac{47}{4} + (-\frac{7}{4}) = 10$ dollars.

Problem 6

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(1)(-3)}{1(1)} = \frac{-3}{1}$.
3. Reduce to -3; check $-3 \div (-3) = 1$.
4. Three days: $3(-3) = -9$ cm.

Problem 7

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(-4)(5)}{1(3)} = \frac{-20}{3}$.
3. Reduce to $-\frac{20}{3}$; check $-\frac{20}{3} \div (\frac{5}{3}) = -4$.
4. Gap: $-\frac{17}{3} - (-\frac{20}{3}) = 1$ liter.

Problem 8

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(3)(-3)}{1(4)} = \frac{-9}{4}$.
3. Reduce to $-\frac{9}{4}$; check $-\frac{9}{4} \div (-\frac{3}{4}) = 3$.
4. Distance $= |-\frac{9}{4} - 0| = \frac{9}{4}$ m.

Problem 9

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(-17)(11)}{5(6)} = \frac{-187}{30}$.
3. Reduce to $-\frac{187}{30}$; check $-\frac{187}{30} \div (\frac{11}{6}) = -\frac{17}{5}$.
4. $-\frac{187}{30} - (-\frac{247}{30}) = 2$ dollars.

Problem 10

1. The sign is negative because the factors have different signs.
2. Multiply numerator and denominator: $\frac{(19)(-7)}{8(12)} = \frac{-133}{96}$.
3. Reduce to $-\frac{133}{96}$; check $-\frac{133}{96} \div (-\frac{7}{12}) = \frac{19}{8}$.
4. $x = \frac{155}{96} - (-\frac{133}{96}) = 3$; check $-\frac{133}{96} + 3 = \frac{155}{96}$.

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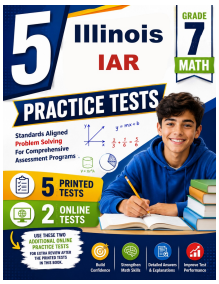

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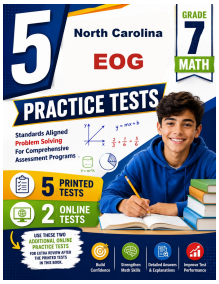

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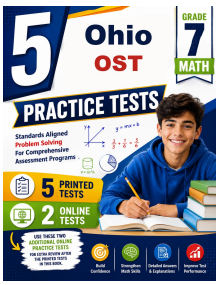

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