Variables in Real-World Problems

Variables in real-world problems: Applications and decisions

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Define what each variable measures. A rule such as $T = 4n + 7$ starts at 7 when $n = 0$ and adds 4 for each increase of 1 in n. A one-time fee is added once, not multiplied by the count. A count uses whole numbers, while a length can be fractional.

Worked example

Each notebook costs 3 dollars plus a 2-dollar delivery fee. Write a cost model. Let n count notebooks; evaluate for $n = 4$.

1. For n notebooks, the 3 dollars per unit contributes $3n$ dollars.
2. The 2 dollars occurs once, giving $C = 3n + 2$.
3. Substitute $n = 4$: $C = 3(4) + 2 = 12 + 2 = 14$ dollars.
Answer: $C = 3n + 2$ dollars; 14 dollars.

Practice Problems

Show your thinking.

1. Art plan A charges 12 dollars plus 4 per project. Plan B charges 6 dollars per project and no fee. Write both rules for n projects. Which is cheaper at 3 projects and at 7?

2. A store uses one fixed fee and one constant price per box. Two boxes cost 11 dollars and five cost 20 dollars. Use b for boxes. Find a rule and explain what it gives at $b = 0$.

3. A rope seller charges 2 dollars per meter plus 4 dollars once. A kit seller charges 2 dollars per whole kit plus 4 dollars once. Both use $C = 2x + 4$. Is $x = 2.5$ allowed in both? Find the cost where it is allowed.

4. A collection begins with 15 cards and gains 2 per trade. Write a rule for n trades. Can 4 trades reach at least 24 cards? Would 5 trades be enough?

5. A group has 35 dollars. One entry fee is 6 dollars and each guest costs 7 dollars. Write the money left after g guests. Compare $g = 4$ and $g = 5$ and explain a negative result.

6. A sale earns 6 dollars per order. It costs 10 dollars once to run. Sam models earnings after costs as $(6 - 10)n$ dollars for n orders. Repair the rule and find how the result changes from 4 orders to 5.

Answer Key

1. $A = 12 + 4n$, $B = 6n$. B at 3; A at 7.
2. $C = 3b + 5$ dollars; the fixed fee is 5 dollars.
3. Only rope. Its cost is 9 dollars.
4. $T = 15 + 2n$. Four give 23 (not enough); five give 25 (enough).
5. $R = 35 - (6 + 7g)$ dollars; 1 dollar left for 4, and 6 dollars short for 5.
6. $E = 6n - 10$ dollars; the result goes up by 6 dollars.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The fee is fixed and the per-project charge is multiplied by n. This gives $A = 12 + 4n$, $B = 6n$.

2. At $n = 3$: A costs $12 + 4(3) = 24$ dollars; B costs $6(3) = 18$ dollars.

3. At $n = 7$: A costs $12 + 4(7) = 40$ dollars; B costs $6(7) = 42$ dollars. The better choice changes.

Problem 2

1. Three extra boxes cost $20 - 11 = 9$ more dollars, so each box adds $9 \div 3 = 3$ dollars.

2. Two boxes account for $2(3) = 6$ of the 11 dollars, leaving a fixed fee of $11 - 6 = 5$ dollars.

3. Thus $C = 3b + 5$. At $b = 0$ the rule gives only the 5-dollar fee.

Problem 3

1. Rope length can be 2.5 m, so $C = 2(2.5) + 4 = 5 + 4 = 9$ dollars.

2. Kit count must be a whole number. The same rule does not make 2.5 kits an allowed input.

Problem 4

1. The 15 starting cards stay fixed and the trades add $2n$, so $T = 15 + 2n$.

2. Four trades: $T = 15 + 2(4) = 23$, below 24.

3. Five trades: $T = 15 + 2(5) = 25$, meeting the target.

Problem 5

1. For g guests, pay $7g$ plus one 6-dollar fee. Subtract this entire cost: $R = 35 - (6 + 7g)$.

2. At $g = 4$, $R = 35 - (6 + 28) = 1$. At $g = 5$, $R = 35 - (6 + 35) = -6$.

3. The -6 means the cost is 6 dollars over budget, not that the group can spend negative money.

Problem 6

1. Only the earnings depend on the number of orders: $6n$. Subtract the 10 setup cost once.

2. At $n = 4$, $E = 6(4) - 10 = 14$ dollars. At $n = 5$, $E = 6(5) - 10 = 20$ dollars.

3. The difference is $20 - 14 = 6$ dollars. One new order adds 6, without a new setup fee.

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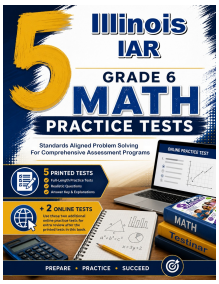

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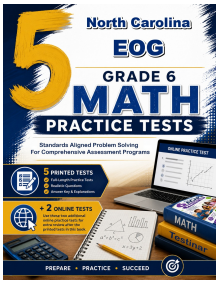

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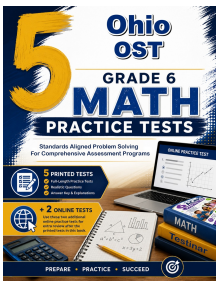

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