

CHAPTER 0 PROJECT

Inventory and Pricing at a Campus Bookstore

You have just been hired as a part-time inventory assistant at your campus bookstore. Your manager needs help calculating costs, markups, discounts, and bulk-order pricing using fundamental algebra skills. Throughout this project, you will work with real numbers, algebraic expressions, exponent rules, radicals, rational exponents, and polynomial factoring to solve practical bookstore problems.

1. The bookstore tracks daily sales using positive and negative values: positive for revenue and negative for expenses. Monday's log reads: +\$1245.80, -\$378.50, +\$892.15, -\$64.00, -\$215.75. Calculate the net result for Monday.
2. The bookstore orders notebooks in bulk. The cost for x notebooks is represented by the algebraic expression $2.40x + 15$, where \$2.40 is the per-unit cost and \$15 is the flat shipping fee. Simplify the expression for the total cost of ordering x notebooks from Supplier A and y notebooks from Supplier B if Supplier B charges $2.85y + 20$. Write and simplify the combined cost expression.
3. The store applies a 25% markup to wholesale prices. If the wholesale cost of a textbook is represented by the expression $(3a + 12)$ dollars, write an expression for the retail price after markup. Distribute and simplify. Then write an expression for the sale price if the store later offers a 10% discount off the retail price. Simplify completely.
4. The bookstore tracks how quickly certain items sell using a doubling model. If a trending notebook sold 3 units the first week it was offered for sale and doubles each subsequent week, the sales for week w are modeled by $3 \cdot 2^{w-1}$.
 - a. Evaluate the expression for $w = 1, 2, 3, 4, 5$, and 6.
 - b. For the 6th week, 96 notebooks are expected to be sold. If after that week we apply the formula $96 \cdot 2^{-w}$, calculate and interpret the expression for $w = 1, 2$, and 3.

5. The bookstore's storage room is square with an area of 450 square feet. Find the side length by computing $\sqrt{450}$. Simplify the radical completely. Then express $\sqrt{450}$ using a rational exponent. Approximate the side length to two decimal places.
6. The manager is comparing shelf dimensions. One shelf unit is $\sqrt{72}$ inches wide and another is $3\sqrt{8}$ inches wide. Simplify each radical. Are the two widths equal? Show your work. Then simplify the expression $\sqrt{50} + 2\sqrt{18} - \sqrt{32}$, which represents a combined measurement across three shelving units.
7. The store models its paper inventory using rational exponents. The number of reams available after t weeks of a semester is approximated by $500t^{\frac{-1}{2}}$.
- Rewrite $500t^{\frac{-1}{2}}$ using radical notation.
 - Evaluate the expression for $t = 4$ and $t = 5$. Interpret each: How many reams are available at week 4 and week 25?
8. The bookstore's revenue from selling x units of a product at price $p = 40 - 2x$ dollars per unit is modeled by the polynomial:
- $$\text{Revenue} = x(40 - 2x)$$
- Expand the expression.
 - Compute revenue when $x = 5$ and when $x = 15$.
 - The store also has a cost polynomial $8x + 50$. Write the profit polynomial, which is given by cost subtracted from revenue and simplify.

9. Consider the profit polynomial from Question 8c.
- Factor out the common factor of -2 , then factor the resulting quadratic completely using the quadratic formula.
 - Find the approximate values of x where the profit polynomial is equal to 0 (the break-even points). What do these values mean for the bookstore?
10. Your manager says: “I never use algebra after school. It’s all just plugging numbers into the register.” Using specific examples from this project, explain how at least three different algebra skills (exponent rules, radical simplification, and polynomial factoring) helped solve real bookstore problems. For each, describe the business decision the algebra supported. Then identify one situation in this project where a calculator alone would have been insufficient without understanding the underlying algebraic structure.