

“3.14159...We Think Math is Really Fine!”

The math team decided to sell t-shirts with their team cheer “3.14159...We Think Math Is Really Fine!” printed on them. They paid \$4.50 per shirt and decided to sell them with a 50% markup. They assumed that every student at WUMS would want to buy one of these shirts so they ordered 250 to sell.

Unfortunately, they only sold 20 t-shirts, and those were to the math team. The team captain suggested they should sell the left over shirts with a 50% discount so they would not lose any money. The team sold the remaining shirts at the new price. How much profit did the team make?

“3.14159... We Think Math is Really Fine!”

Suggested Grade Span

Grades 6–8

Grade in Which the Task Was Piloted

Grade 8

Task

The math team decided to sell t-shirts with their team cheer “3.14159...We Think Math Is Really Fine!” printed on them. They paid \$4.50 per shirt and decided to sell them with a 50% markup. They assumed that every student at WUMS would want to buy one of these shirts so they ordered 250 to sell. Unfortunately, they only sold 20 t-shirts, and those were to the math team. The team captain suggested they should sell the left over shirts with a 50% discount so they would not lose any money. The team sold the remaining shirts at the new price. How much profit did the team make?

Alternative Versions of Task

More Accessible Version:

The math team decided to sell t-shirts with their team cheer “3.14159...We Think Math Is Really Fine!” printed on them. They paid \$4.50 per shirt and decided to sell them with a 50% markup. They assumed that every student at WUMS would want to buy one of these shirts so they ordered 250 to sell. If they sell all of the t-shirts, determine the profit the team will make.

More Challenging Version:

The math team decided to sell t-shirts with their team cheer “3.14159...We Think Math Is Really Fine!” printed on them. They paid \$4.50 per shirt and decided to sell them with a 50% markup. They assumed that every student at WUMS would want to buy one of these shirts so they ordered 250 to sell. Unfortunately, they only sold 20 t-shirts, and those were to the math team. The team captain Sally suggested they should sell the left over shirts with a 50% discount so they would not lose any money. Tom tried to convince Sally that they would actually lose money by doing this. Who is right? If Tom is, for what percent off should they sell the t-shirts so they can break-even?

NCTM Content Strands and Evidence

Number Standard for Students in Grades 6-8

Instructional programs from Pre-Kindergarten through grade 12 should enable all students to...

- Understand numbers, ways of representing numbers, relationships among numbers and number systems.
 - *NCTM Evidence:* In grades 6-8 all students should work flexibly with fractions, decimals and percents to solve problems.
 - *Exemplars Task Specific Evidence:* This task requires students to use percents as they relate to markups and discounts.

Time/Context/Qualifiers/Tip(s) from Piloting Teacher

The eighth graders who piloted this task finished the solution within one 45-minute class period. This task allows students to explore a real-life situation in which markup and discount are used. At first glance, most students thought the team captain's logic (that discounting the shirts 50% would protect them from losing money) made sense and were surprised at the correct answer.

Links

This task could link to other fund-raising events.

Common Strategies Used to Solve this Task

Most students used calculators to manipulate the numbers in the task.

Possible Solutions

Original Version:

The math team actually lost \$212.60 by selling the remaining shirts at 50% off.

$$\$4.50 \times 150\% = \$6.75 \text{ (initial price for t-shirts)}$$

$$\$6.75 \times 50\% \text{ off} = \$3.38$$

$$\$4.50 - \$3.38 = \$1.12 \text{ loss} \times 230 \text{ t-shirts} = \$257.60 \text{ loss}$$

Profit from the 20 shirts sold to the math team:

$$20 \times \$2.25 = \$45$$

$$\text{Loss offset by profit of 20 shirts} = \$257.60 - \$45 = \$212.60$$

More Accessible Version:

$$\$4.50 \times 50\% = \$2.25 \times 250 \text{ t-shirts} = \$562.50$$

More Challenging Version:

$\$4.50 \times 150\% = \6.75 (initial price for t-shirts)

$\$6.75 \times 50\%$ off = $\$3.38$ so there would be a loss of $\$1.12$ per shirt.

The correct discount would be a $1/3$ discount.

$\$6.75 \times 33.3\% = 2.25$

$\$6.75 - \$2.25 = \$4.50$

Task Specific Assessment Notes

General Notes: This task does not lend itself well to students needing to create a math representation as a problem-solving strategy, so the student should not be penalized for not doing so.

Novice: The Novice has difficulty understanding the concepts of percent markup and discount, and makes little or no progress in solving the task.

Apprentice: The Apprentice has the ability to manipulate the numbers, but does not understand the overall concept of markup, discount or profit. The Apprentice does not achieve a solution, or arrives at an incorrect solution due to a computation error or omission error.

Practitioner: The Practitioner will solve the task correctly, and will have accurate and organized work to support the solution.

Expert: The Expert will correctly solve the task and then extend the solution to include an alternative plan for the math team to follow. All work will be shown and labeled. Precise math language will be used.

Author

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Exemplars

Novice

Portfolio task
Factors of math problem
4.50 each 50% markup

250 shirts Only math team bought - 20 kids

Captain suggest 50% off (no loose \$)

How much profit?

$$\begin{aligned} & \text{((4.50} \times 250) \text{ (2.25} \text{ markup} \times 250) =} \\ & \text{\$ spent on shirts + 50\% of all shirts bought} \\ & \text{\$ 50 \uparrow} \\ & 1125 + 625 = 6750 \\ & 6300 - 6750 = -450 \end{aligned}$$

20 kids 1st had them
50% markup, then 50% \downarrow = regular price
~~4.50~~ \times 230 = ~~1035~~ other students
6.75 ~~4.50~~ \times 20 = ~~90~~ ¹²⁵ math team

$$\begin{aligned} & + 125 \$ \\ & \underline{517.5} \\ & 642.5 - 1125 = -482.5 \end{aligned}$$

The student has no concept of mark-up, discount or profit, so is unable to proceed toward a correct solution.

They did not make any profit, because they sold the shirts to other students half off, and only 20 students bought the shirts with the markup rate.

Apprentice

The student understood mark-up and discount, but not profit.

$\$4.50$ 50% MARKUP
 225
 $\text{Price} = 6.75 \times 250 = \text{shirts}$
 $\$1,687.50$
 $\text{Price} = 6.75 \times 20 = \text{Kids on math team}$
 $\$135.00$
 $6.75 \times .50 = 3.375$
 $\$3.38$
 $\$3.38 \times 250 = \845.00
 Profit from remaining shirts = $\$845.00$

In the portfolio task we were trying to find out how much the math team would of made if all the shirts sold for $\$6.75$ which would of been $\$1,687.00$. When only the 20 kids on the team bought the shirts they only made $\$135.00$. They decided to reduce the price 50% so they would sell. The final price of that was $\$3.38$ when all the shirts sold the final profit was $\$845.00$.

Some math language is used to communicate, but the work lacks organization.

Practitioner

The student achieves a correct solution.

Math language is used to communicate.

The team bought 250 t-shirts for \$4.50 each. Meaning they had to spend \$1125⁰⁰ on it. But only 20 kids bought t-shirts for \$6.75. Meaning they only made \$135⁰⁰. So the team decided to lower the price 50% which came out to be \$338. They then sold the rest of the t-shirts coming up with a total of \$912.40. The team did not make a profit in fact they lost \$212.60. I am glad I am not the math team.

Awareness of the audience is evident.

Relevant observations about the solution are made along the way.

Exemplars

Practitioner cont.

Handwritten calculations and diagrams illustrating a business problem involving shirts and shirtscost.

Initial Calculations:

$$\begin{array}{r} 4.50 \\ - 2 \\ \hline 2.25 \end{array}$$

$$\begin{array}{r} 4.50 \\ + 2.25 \\ \hline 6.75 \end{array}$$

\$6.75 for a shirt → 20 kids bought the shirts

20 shirts:

$$\begin{array}{r} 6.75 \\ \times 20 \\ \hline 135.00 \end{array}$$

Shirts cost:

$$\begin{array}{r} 4.50 \\ \times 250 \\ \hline 1125.00 \\ \hline 1125 \\ + 135 \\ \hline 1260 \end{array}$$

Profit Calculation:

$$\begin{array}{r} 4.50 \\ \times 20 \\ \hline 90 \end{array}$$

90 → 45 dollar profit

Final Calculations:

$$\begin{array}{r} 6.75 \\ \div 50 \\ \hline 3.38 \end{array}$$

$$\begin{array}{r} 280 \\ - 20 \\ \hline 230 \end{array}$$

$$\begin{array}{r} 230 \\ \times 3.38 \\ \hline 777.4 \end{array}$$

$$\begin{array}{r} 135 \\ + 777.4 \\ \hline 912.40 \end{array}$$

$$\begin{array}{r} 1125.00 \\ - 912.40 \\ \hline 212.60 \end{array}$$

NO profit at all

Work is shown to support the solution.

Exemplars

Expert

Precise math language is used throughout.

$\$4.50$ each \times 250 shirts = $\$1,125$ spent to get all 250 shirts.
 each $\$4.50$ each \times .50(%) markup = $\$2.25$ markup + 4.50 each = $\$6.75$
 The math team is trying to sell the t-shirts at $\$6.75$ each
 $\$6.75 \times 20$ shirts sold to math team = $\$1.35$ got.
 ~~$\$6.75$~~ ~~$\times$~~ ~~$20$~~ $6.75 - 4.50 = \$2.25$ profit for each of the 20 shirts sold. $\$2.25 \times 20$ shirts = $\$45$ profit.

$\$6.75$ per shirt \times .50(%) off sale = $\$3.38$ a shirt.
 The math team bought the shirts for $4.50 - 3.38$ that they ~~made~~ got from each shirt = $\$1.12$ per shirt that the math team lost.
 250 students - 20 students = 230 students
 230 students \times $\$1.12$ lost on each = $\$257.60$ lost on the shirts
 257.60 lost - the $\$45$ profit from the earlier shirts sold = the math team lost $\$212.60$ on the t-shirt sale.
 If the math team sold the shirts at $\$6.75$ with a 30% discount they would have only made $\$.22$ on each shirt.
 ~~$\$230$~~ 230 students \times $\$.22$ = made would have equaled $\$50.60$ profit plus $\$45$ profit from the earlier 20 shirts sold total profit would have been $\$95.60$ profit that would have been made for the Math team.

All work is shown, labeled and organized for the audience.

The student calculates a correct solution and extends the task by determining how the math team could make a profit.