

Indoor Paintball Field Trip

The eighth grade teachers want to bring their class to Vermont Indoor Paintball for an end-of-the-year celebration. They plan to reserve the field for 3 (non-peak) hours. They estimate that each person will use 500 paintballs in a 2-hour session. Tax is 5%. There are a total of 92 eighth graders.

Use the information on the attached sheet (please see following page) to determine the total cost of the trip, and how much money each student needs to contribute toward the cost.

★ Vermont Indoor Paintball ★

Group reservations can be made for 1, 2, or 3 hours. Group rates are composed of two parts:

- 1) A per person field fee
- 2) The cost of the paint used

The field is:

| | |
|-----------------------|---------|
| 1 hour of field use: | \$10.00 |
| per person | |
| 2 hours of field use: | \$15.00 |
| per person | |
| 3 hours of field use: | \$20.00 |
| per person | |

Paint is sold in quarter case increments.

The cost of paint is:

| | |
|----------------------------|---------|
| 1/4 case (500 paintballs) | \$20.00 |
| 1/2 case (1000 paintballs) | \$36.19 |
| 1 case (2000 paintballs) | \$70.48 |

There is a minimum charge to reserve the field. The minimum charge can be made of a combination of the per person field fee and the cost of the paint. Minimum rates vary with peak and non-peak times. Minimum charges are as follows:

| | |
|--------------------------|---------------|
| 1 hour (non-peak) \$200 | 1 hour (peak) |
| \$500 | |
| 2 hours (non-peak) \$400 | 1 hour (peak) |
| \$1000 | |
| 3 hours (non-peak) \$600 | 1 hour (peak) |
| \$1500 | |

Indoor Paintball Field Trip

Suggested Grade Span

Grades 6–8

Grade in Which Task Was Piloted

Grade 7 and 8

Task

The eighth grade teachers want to bring their class to Vermont Indoor Paintball for an end-of-the-year celebration. They plan to reserve the field for 3 (non-peak) hours. They estimate that each person will use 500 paintballs in a 2-hour session. Tax is 5%. There are a total of 92 eighth graders.

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Alternative Versions of Task

More Accessible Version:

The eighth grade teachers want to bring their class to Vermont Indoor Paintball for an end-of-the-year celebration. They plan to reserve the field for 3 (non-peak) hours. They estimate that each person will use 250 paintballs in a 1-hour session.

There are a total of 92 eighth graders.

Use the information on the attached sheet to determine the total cost of the trip.

More Challenging Version:

The eighth grade teachers want to bring their class to Vermont Indoor Paintball for an end-of-the-year celebration. They plan to reserve the field for 3 (non-peak) hours. They estimate that each person will use 500 paintballs in a 2-hour session. Tax is 5%. There are a total of 92 eighth graders.

Use the information on the attached sheet to determine the total cost of the trip, and how much money each student needs to contribute toward the cost.

When you complete this task, choose another location for an 8th grade trip. Investigate the cost and compare it to the cost of the Indoor Paintball trip. Make a recommendation to the 8th grade teachers on which would be the more economical trip. Support your decision mathematically.

★ Vermont Indoor Paintball ★

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| 2 hours (non-peak) \$400 | 1 hour (peak) |
| \$1000 | |
| 3 hours (non-peak) \$600 | 1 hour (peak) |
| \$1500 | |

NCTM Content Standards and Evidence

Number and Operation Standard for Grades 6–8

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

- Compute fluently and make reasonable estimates.
 - *NCTM Evidence:* Select appropriate methods and tools for computing with fractions and decimals from among mental computation, estimation, calculators or computers, and paper and pencil, depending on the situation, and apply the selected methods.
 - *Exemplars Task Specific Evidence:* This task requires students to multiply and divide to find the cost of the field trip.

Time/Context/Qualifiers/Tips From Piloting Teacher

This task is a short to medium task in that it took my students 45 minutes or less to obtain a solution. Paintball is a sport that many students find interesting which will assist in motivating them to solve the problem.

Links

This task could be adapted to any field trip you are taking with your students.

Common Strategies Used to Solve the Task

Most students will use a straight computational approach to solve this task.

Possible Solutions

Original Version:

This solution assumes that tax applies to paintballs purchased plus field fees. It is also assumed that the exact needed number of paintballs is purchased. For other interpretations, see the expert's solution.

\$600 minimum field fee. Compare that to: $92 \text{ kids} \times \$20 \text{ per person for 3 hours of field use} = \1840 for actual field fee. This is the price you will be charged.

$$92 \times 750 = 69000 \text{ paint balls needed}$$

$$69000 \div 2000 \text{ (per case)} = 34.5 \text{ cases}$$

$$34 \text{ cases} \times \$70.48 = \$2396.32$$

$$1/2 \text{ case} = \$36.19 + \$2396.32 = \$2432.51 \text{ total for paintballs}$$

$$\$1840 \text{ (field fee)} + \$2432.51 \text{ (paintball fee)} = \$4272.51 \times 5\% \text{ tax} = \$213.63$$

$$\$4272.51 \text{ Total} + \$213.63 \text{ tax} = \text{Grand total } \$4486.14$$

$$\$4486.14 \div 92 \text{ students} = \$48.76 \text{ per student}$$

More Accessible Version:

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More Challenging Version:

The solution to the first part of the problem will be the same. The student will need to provide documentation of the facts about another possible field trip for you to use in verifying their computation, approach, and reasoning.

Task Specific Assessment Notes

General Notes: One flaw in reasoning students may make about the circumstantial situation in the task is that you can buy a half case of paintballs at the same unit rate as a whole case. Since half case rates are listed, it is clear that you must pay the different rates.

Novice: The novice will have little or no understanding of the task. Data presented in the task may be randomly manipulated with no correct reasoning. Little or no math language will be used, and no math representations will be attempted.

Apprentice: The apprentice will have a partially complete or partially correct solution. An answer in the correct ballpark may be achieved, but it will be a result of incorrect reasoning or computation errors.

Practitioner: The practitioner will have a correct solution with all parts labeled and organized. Some formal math language will be used to communicate, but the task itself doesn't lend itself well to its use.

Expert: The expert will utilize the open-endedness of the task to her/his benefit. Efficient strategies will be used, analysis of the mathematical situation will be evident, and evidence will be used to support and justify correct conclusions. A sense of purpose will be communicated to the audience, and math connections will be used to extend the solution.

Author

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Exemplars

Novice

\$600.00 for 3 non-peak hours ÷ by 92 students
= 6.52 dollars.

Each student needs to bring in 6.52 dollars for
3 non-peak hours.

Little or no understanding of the
task is demonstrated.

Apprentice

Although an answer that looks correct is achieved it is done so using incorrect reasoning as the student is unclear how to apply the \$600 minimum charge, and appears to include the price of paintballs twice.

| | |
|--|----------|
| 500 paint balls | \$20.00 |
| 3 hours of playing time | \$20.00 |
| Indoor Paintball 3 hour to reserve field (non-peak) | \$600.00 |

The eighth grade teachers want to bring their class to Vermont Indoor Paintball for an end-of-the-year celebration. They plan to reserve the field for 3 (non-peak) hours.

They estimate that each person tends to use 500 paintballs in a 2-hour session.

Tax is 5%.

There are a total of 92 eighth graders.

Use the information on the attached sheet to determine the total cost of the trip, and how much money each student needs to contribute toward the cost.

An attempt is made to create a math representation but it has little relevance nor use as a problem solving strategy.

$$92 \times \$20.00 + 5\% = \$1932$$

$$1932 + 600 = \$2532$$

Price per ball + price of paintballs + to reserve field + tax
 = # of people going

$$2532$$

$$+ 1932$$

$$\frac{4464}{92} = \$48 \text{ per person}$$

for another 3 hours take

$$4464 \times 2 = 8928 \div 92 = \$97$$

Exemplars

Practitioner

A correct answer is achieved.
All work is shown and labeled, and all parts of the task are addressed with an adequate mathematical basis.

$$\begin{aligned} 3 \text{ hours} &= \$ 20.00 \\ 500 \text{ paintballs} &= \$ 20.00 \end{aligned}$$

$$\begin{aligned} 250 \text{ paintballs} &= 1 \text{ hour} \\ \times \quad 3 \\ \hline 750 \text{ paintballs total} \end{aligned}$$

$$\begin{array}{r} 1 \text{ box} \rightarrow 2000 \overline{) 69000} \\ \underline{34.5} \end{array}$$

$$\begin{array}{r} 750 \text{ Paintballs} \\ \times 92 \text{ students} \\ \hline 69000 \text{ Paintballs} \end{array}$$

$$\begin{array}{r} \text{field fee} \times 20 \\ \times 92 \\ \hline 1840 \end{array}$$

$$\begin{array}{r} 34 \text{ boxes} \\ \times 70.48 \\ \hline \$ 2396.32 \\ + 36.19 \leftarrow \times 2 \text{ box} \\ \hline 2432.51 \\ + 2432.51 \text{ Paint} \\ + 1840 \text{ field} \\ \hline \$ 4272.51 \text{ total} \end{array}$$

$$\begin{array}{r} 4272.51 \\ \times 1.15 (5\% \text{ tax}) \\ \hline 92 \overline{) 4486.14} \\ - \$ 48.76 \text{ per student} \end{array}$$

Expert

All aspects of the task are considered and correctly executed. Evidence is used to support the student's claim that the decisions you make will affect the price.

My Paintball Solution

This problem asks you to make some decisions. The decisions you make will make a difference on the price. I will show you.

First of all, you have to figure out how much the field will cost to rent. They say you have to pay a 600 dollar minimum, but don't worry, this will cost way more than that. To get the cost of the field you have to multiply 92 kids times 20 dollars per kid. Some adults or teachers may want to play too, but I cannot figure that out now. So the cost of the field is \$1840.00.

Next you have to figure out how much the paintballs cost. Mrs. McNair said that kids use about 500 paintballs in two hours (I think I use more, but oh well). That means that kids use about 250 paintballs in one hour, so in 3 hours they would use 750. If each kid uses 750 then you need $750 \times 92 = 69,000$ paintballs- wow! That's a lot. To find how many cases we would need to buy you have to divide 69,000 by 2000 (the number in a case) and you get 34.5 boxes. Now comes one of those decisions I was talking about. You can either round the cases to 35 thinking that some kids will want to use more than 750, or you can buy 34 whole cases, and 1 half case. Here is the price difference:

$$35 \text{ cases} \times \$70.48 = \$2,466.80$$

$$34 \text{ cases} \times 70.48 = \$2,396.32 + \$36.19 \text{ for 1 half case} = \$2,432.51 \text{ This is the least expensive way by } \$34.29.$$

So now you can find the total cost. The sheet that Mrs. McNair got from V.I.P. states that you need to pay 5% for tax. It is not clear if that 5% is on the paintballs only, or on the whole tab. It seems it would just be for paintballs, but maybe not. So here is the different ways of looking at it.

No tax on field:

$$35 \text{ cases of Paintballs } \$2,466.80 \times 5\% \text{ tax} = \$123.34 + \text{field } \$1840.00 = 4430.14 \text{ divided by } 92 \text{ students} = \$48.15 \text{ per student.}$$

$$34 \text{ cases plus 1 half case of Paintballs } \$2,432.51 \times 5\% = \$121.63 + \text{field } \$1840 = \$4394.14 \text{ divided by } 92 \text{ students} = \$47.76$$

With tax on field:

$$35 \text{ cases of Paintballs } \$2,466.80 \times 5\% \text{ tax} = \$123.34 + \text{field } \$1840.00 \times 5\% \text{ tax} = \$92.00 = 4522.14 \text{ divided by } 92 \text{ students} = \$49.15 \text{ per student.}$$

$$34 \text{ cases plus 1 half case of Paintballs } \$2,432.51 \times 5\% = \$121.63 + \text{field } \$1840.00 \times 5\% \text{ tax} = \$92.00 = \$4486.14 \text{ divided by } 92 \text{ students} = \$48.76$$

There is only a dollar difference per kid if you tax the field rate, so you might as well ask kids to bring in the extra dollar just in case. In fact, you may as well not mess around and just ask each kid to bring in \$50.00 each. That takes care of every scenerio and gives a little cushion too.

I think this is a lot of money for kids to bring for a field trip to a place just down the road from where we live. For that much money you think we could go someplace out of state. Maybe they should let the kids vote. Don't get me wrong, I love paintball as much as the next guy, but I think it costs a little much for a school field trip.

Math language along with a sense of audience and purpose is communicated throughout the solution. The student analyzes the situation in mathematical terms.