Making Candles

Emily started to make candles to sell at the school fair to raise money for her class trip. At the craft shop, Emily found out the following:

Candle wick sells at 3 yards for $1.67.

Wax sells in blocks for $3.79. Each block will make 25 candles the size that Emily plans to make.

Each candle is made the same way. Nine inches of wick is used with one end tied onto the middle of a stick. The wick is dipped into a can of melted wax and is then supported between two brackets so that the wax can harden before dipping the wick again. Emily has to dip the wick 10 times to get the size she wants. The candle must harden 2 minutes between each dip.

As the wax is hardening, Emily prepares a new wick for dipping. She also continues to add wax to the melting pot. When the candle is finished, Emily will trim the wick.

Emily made candles from 9:00 AM to 3:30 PM each day for five days. Every day she had an hour off for lunch. She also had 3 fifteen–minute breaks.

Emily decided to sell each candle for $0.75 because she wanted to earn at least $30.00. Using all of the information given, mathematically estimate whether or not Emily will meet her goal. Show your math thinking.

Making Candles

Suggested Grade Span
Grades 3–5

Grade(s) in Which Task Was Piloted
Grade 5

Task
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Alternative Versions of Task

More Accessible Version:
Emily started to make candles to sell at the school fair to raise money for her class trip. At the craft shop, Emily found out the following:

Candle wick sells for 2 cents per inch.

Wax sells in blocks for $3.79. She will need 3 blocks of wax, as she plans to make 71 candles in all.

Each candle is made the same way. Nine inches of wick is used with one end tied onto the middle of a stick. The wick is dipped into a can of melted wax and is then supported between two brackets so that the wax can harden before dipping the wick again.

As the wax is hardening, Emily prepares a new wick for dipping. She also continues to add wax to the melting pot. When the candle is finished, Emily will trim the wick ends.

Emily decided to sell each candle for $0.75 because she wanted to earn at least $30.00. Using all of the information given, mathematically estimate whether or not Emily will meet her goal. Show your math thinking.

More Challenging Version:
See "Making Candles" in the grade 6–8 tasks

NCTM Content Standards and Evidence

Number and Operation Standard for Grades 3–5

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

- Compute fluently and make reasonable estimates.
  - ***NCTM Evidence***: Develop fluency in adding, subtracting, multiplying, and dividing whole numbers.
  - Develop and use strategies to estimate computations involving fractions and decimals in situations relevant to students' experience.
  - Select appropriate methods and tools for computing with whole numbers from among mental computation, estimation, calculators, and paper and pencil according to the context and nature of the computation and use the selected method or tools.

- ***Exemplars Task Specific Evidence***: This task requires students to add, subtract, multiply and divide measurements, money represented in decimal form, and whole numbers.

Measurement Standard for Grades 3–5

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

- Understand measurable attributes of objects and the units, systems, and processes of measurement.
  - ***NCTM Evidence:*** Carry out simple unit conversions, such as from centimeters to meters, within a system of measurement.
  - ***Exemplar Task Specific Evidence:*** This task requires students to convert between inches and yards, and between hours and minutes.

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

This is a medium to long length task. Students who are introduced to and allowed to make their own candles will be more invested in solving this task. You might find a parent who would be willing to come in to demonstrate candle making, or you may live near a candle making company where you can visit.

Links

This task could be given to students during a unit on colonialism. They can learn how the colonists made candles and about other colonial crafts.

Common Strategies Used to Solve This Task

Successful students will find a way to organize their work to be sure to include all aspects of the task. This task requires the application of some estimation skills or assumptions about the time it takes to perform the different tasks. For instance, some students may assume it takes 20 minutes to make each candle (2 minutes x 10 dips), while others may add some time for set up, clean up, etc. Correctness of solution should be evaluated on how accurately the solution is calculated based on the student's assumptions.

Possible Solutions

Original Version:

9:00 – 3:30 = 6.5 hours – 1 hour for lunch = 5.5 hours – 45 minutes in breaks = 4 hours and 45 minutes of candle making time x 5 days = 23 hours and 45 minutes which equals 1425 minutes.

Each candle takes approximately 10 dips x 2 minutes = 20 minutes. 1425 minutes ÷ 20 minutes a candle = about 71 candles made in all.

Emily's Expenses:
71 candles x 9" of wick = 639" ÷ 36" = 17.75 yards of wick. 17.75 ÷ 3 yards per package = 5.916 packages needed, so round to 6 packages x $1.67 = $10.02.

1 wax block makes 25 candles, so 3 wax blocks will make 75 candles. 3 x $3.79 = $11.37

Wax + wick = $21.39 for total expenses.

Emily's Income
71 candles x .75 = $53.25

Emily's Profit

$53.25
− $21.39
$31.86 profit, so yes, she is able to raise at least $30.

Answers may vary depending on how numbers in calculations are rounded.

More Accessible Version:
Cost of Making Candles
$3.79 x 3 = $11.37 in wax
71 candles x 9 inches of wax x 2 cents per inch = $12.78
Total cost of candles = $24.17

Income from candles
71 candles x .75 = $53.25

Profit
29.08 so she almost makes $30, but she is a few cents short.

More Challenging Version:
See 6–8 candle making task notes.

Task Specific Assessment Notes

General Notes: Clear communication will be essential in the practitioner solution. This task has many aspects, so it will be important to organize the solution for maximum success.

Novice: The novice will demonstrate little or no understanding or engagement in the task. Little or no correct reasoning will be present. There are many parts to this task that the student must address. The novice will be unable to address any significant part(s).

Apprentice: The apprentice will have a partially correct solution with a strategy that will work for solving part of the task. The apprentice will use some correct reasoning, and may make an attempt to organize and communicate work for some of the multi parts of the task. An incorrect solution may be achieved due to computation errors, reasoning errors, or from neglecting to utilize all information presented in the task.

Practitioner: The practitioner will achieve a correct solution to the task with supporting work. The approach will be systematic so as to include all relevant information. There will be clear communicate with the audience. Some math observations may be recognized, but not used, such as that Emily raised more than enough money.

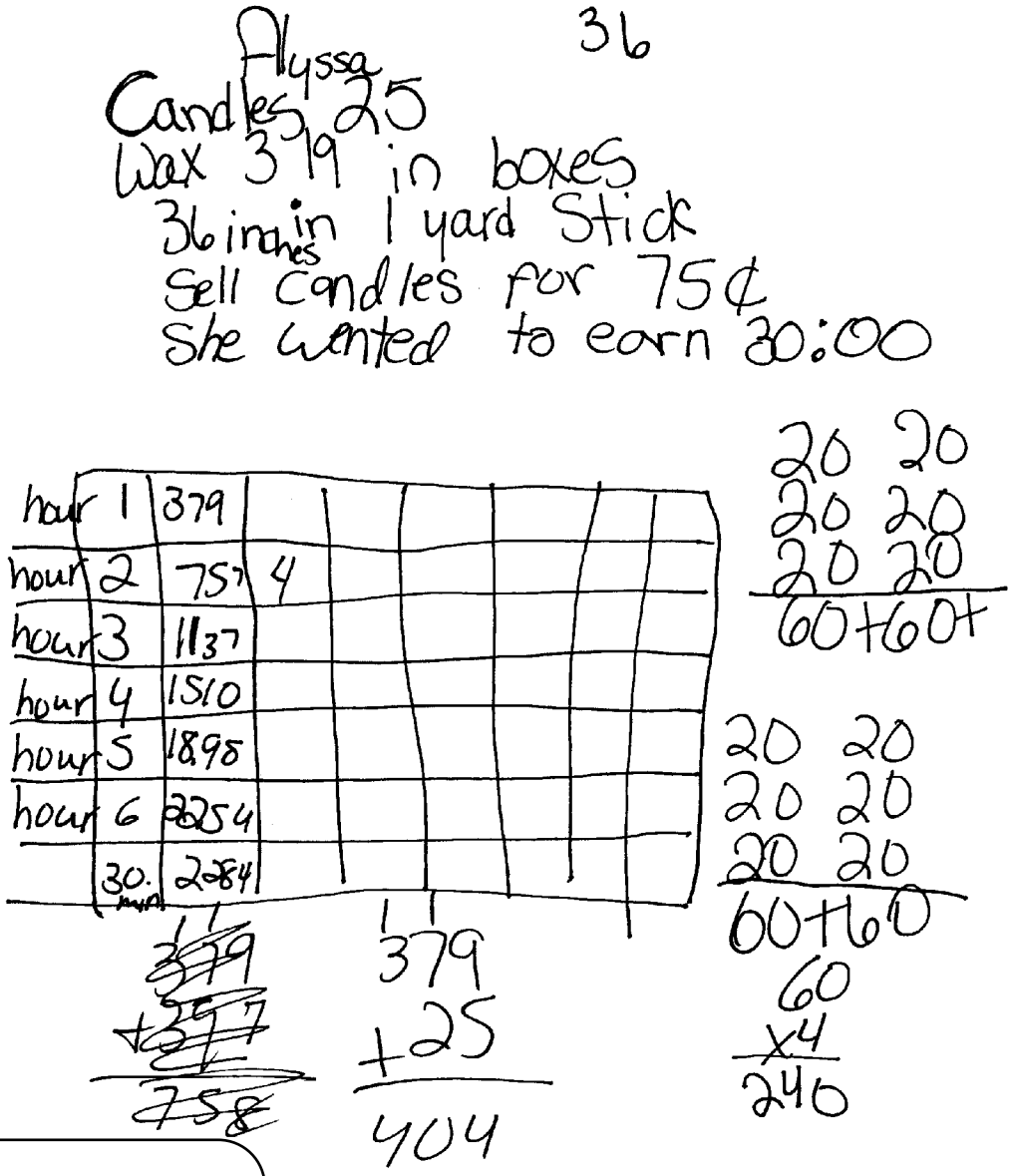
Expert: The expert will not only achieve a correct solution, but will also utilize other good problem solving strategies such as creating a rule to solve the task, verifying the solution, or going above and beyond the task requirements. The expert will rely on succinct computational approaches to solving the problem. The expert may analyze how profits may be adjusted, or will make a rule for determining the cost per candle.

Author

This task was written by **Deb Armitage**, Pre K–8 Mathematics Assessment Consultant at the Vermont Department of Education. The task was piloted by teachers and students in Vermont.

Novice

Little or no parts are correct. The student has no strategy for determining the number of minutes.



The student misunderstands the number of candles that will be made with the number of candles that can be made with 1 package of wax.

It is unclear how the student plans to use this data. No conclusion is achieved.

Apprentice

Some awareness of audience is present as the student explains the approach used. A total of 70 candles can be made.

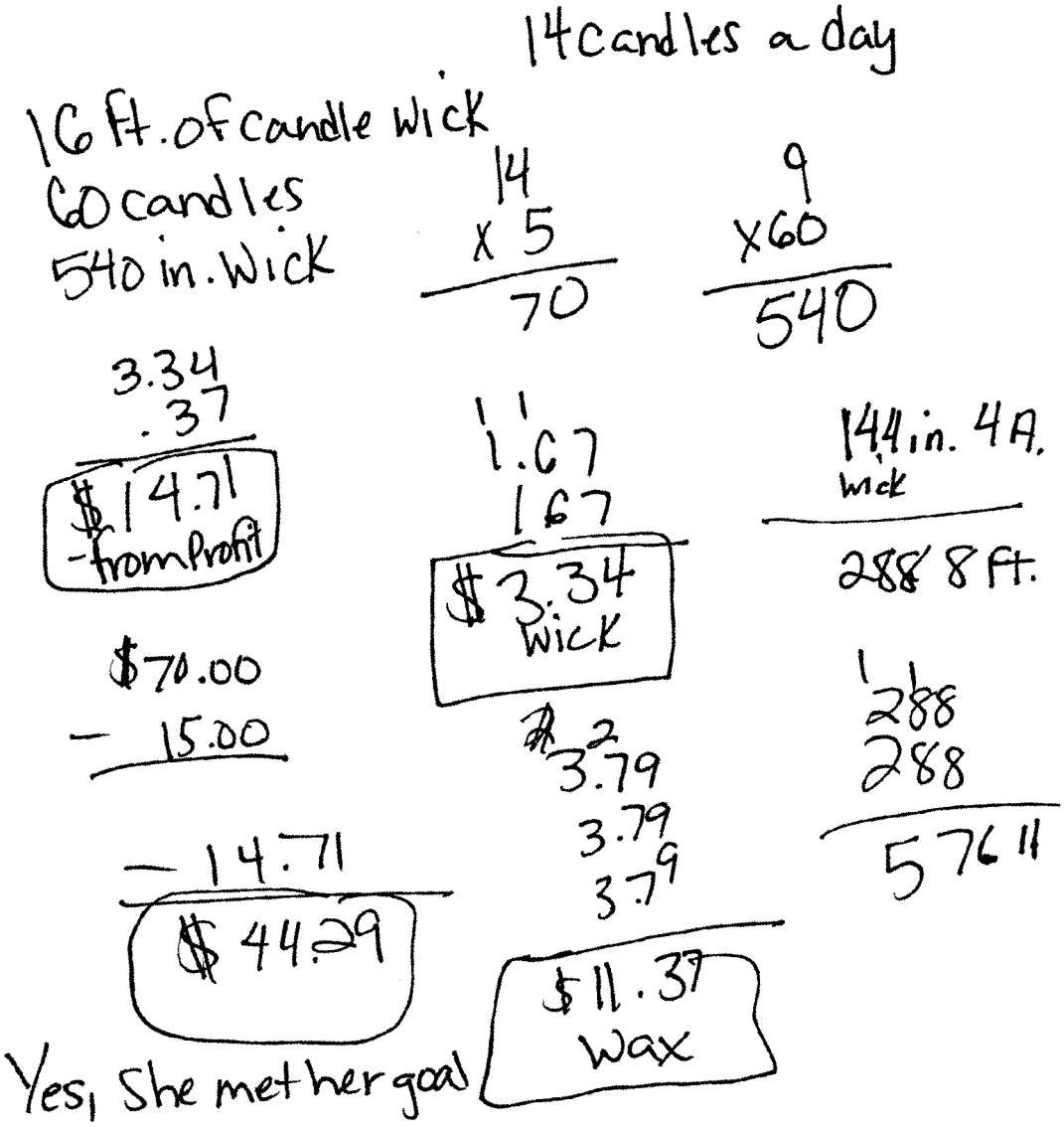
Yes, Emily met her goal. What I came up with was $44.29. I figured out that she made 14 candles a day for 5 days. What I did was I round the candle price to $1.00, so it would be $60.00, then I divided $60 by 4. So I minused $15 from my $70.00 profit. Then I minused $14.71 from $55.00, for the materials she bought.

She sold 70 candles, and made $44.29

The student correctly determines that 14 candles can be made per day. The approach of substracting the cost from profit is correct.

Some parts of the student's solution are correct. Although not necessary, it is reasonable to round the price per candle to $1.00.

Apprentice cont.



The student incorrectly determines the amount of candle wick needed and therefore the cost is incorrect as well.

Work is shown and labeled. The student uses the approximately equal to sign correctly in communicating the solution.

Practitioner

The student accounts for the extra 5 minutes available each day.

All work is shown, labeled, and correct.

Emily buys 18 yards of wick She spents $10.02. Then She buy 3 blocks of wax for $11.37. Then all together She spends $21.39.

Emily 9:00 AM to 3:30 PM She works 6.30 mins then She has 1:00 hour lunch brack ant then three 15 minubrackes She works 4:45 all together. She makes 14 candles a dax and 70 all together.

70
x.75
13.50
+49.0
$52.50

then

52.50
-21.39
$31.11 ← answer is yes

4hr 45 = 14 candles
240+45 = 285 min
285 ÷ 20 = 14 (5 extra min)

Here's my thinking all together

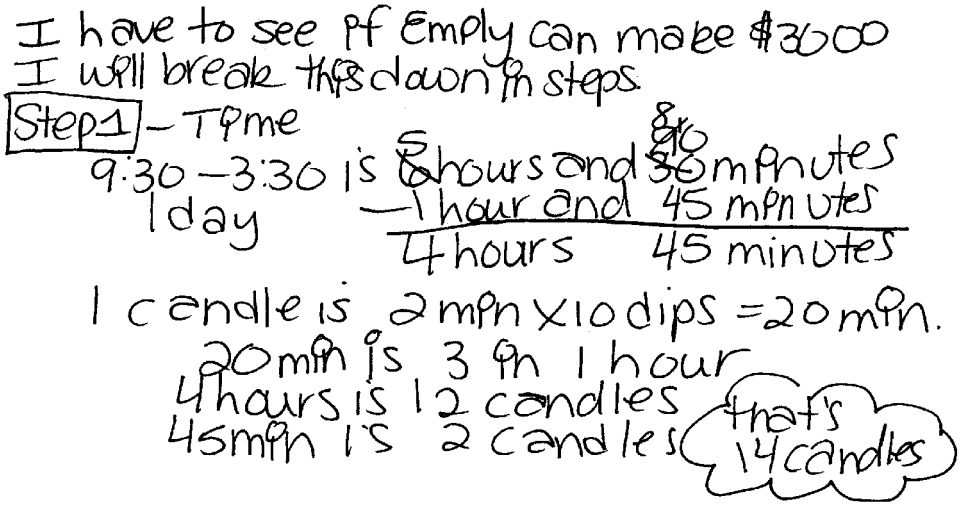
day	time	total time	total candles	total wick
1	4hr 45min	4hr45min	14	126"
2	4hr 45min	9hr 30 Min	28	252"
3	4hr45min	14hr 15 min	42	378"
4	4hr45min	19hr	56	504"
5	4hr45 min	23hr45min	70	630"

630 ÷ 36 = 17 = 18 yds
18 yards 18

25+25+25 = 75
3 blocks

Math language and representations are used to organize and communicate the solution

Expert



Work is very well organized and labeled, making the approach and reasoning clear to the audience.

Expert cont.

A chart is used to organize and communicate the solution.

The student extends the solution by determining the amount earned over $30, as well as how much would be paid for candles made every day for a month.

Emily's Candles

day	candles per day	wick per day
1	14	126"
2	14	126"
3	14	126"
4	14	126"
5	14	126"
total	70	630"

3
14
x9
126

step2 - Buying

wick 630" = 18 yards
blocks 3

18 3x6=18
36|630 3x$1.67
3x$3.79
6x$1.67

step3 - money to spend

$1.67 x 6 $10.02
$3.79 x 3 $11.37
$21.39

step6 - extra

14 x 30 = 420
candles x days = total candles
420 x .75 = $315.00

step4 selling candles

70 x .75 $52.50

step5 - profit $52.50
-21.39
$31.11

Emily made $1.11 more than she hopet too.