CLASSROOM QUICKIES
Book 3

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PURPOSE:
This book is intended to provide your students with interesting problems to think about on those days when your lesson plans do not quite cover the class period—days when there's not enough time for another lesson or for the students to get a good start on their homework assignment but there’s too much time left over just to waste.

GENERAL INFORMATION:
There are three collections of problems in this series, all of which are available in both booklet and duplicating master form:
- CLASSROOM QUICKIES - Book 1
- CLASSROOM QUICKIES - Book 2
- CLASSROOM QUICKIES - Book 3

The title—CLASSROOM QUICKIES—is meant to imply that within 2-10 minutes each problem can be thoroughly presented and the students can start thinking about its solution. But for many problems, the students will not find the solutions within this time.
None of the problems is hard to understand. But solving them is sometimes a different matter, since they range from easy to hard. Each of the three collections of problems has some problems in each range of difficulty but, for the most part, the hard problems in Book 3 require more thought than those in Book 2, and the hard problems in Book 2 require more thought than those in Book 1.

In general, it is suggested that you NOT give your students the answers to these problems. Students have been known to work for days, even weeks and months, to solve some of these problems.

ANSWERS:
1. It is possible.
2. You've gained $40. You paid out a total of $80 the two times you bought the goods, but you took in a total of $120 the two times you sold it. 3. The final stock is 28,147,497,671,065,566 kilometers. 4. Wisdom is the principal thing. Therefore, get wisdom, and with all thy getting, get understanding. 5. Fill the 4-liter jug. Fill the 3-liter jug from it and then empty the water from the 3-liter jug into the 10-liter jug. Then empty the remaining one liter of water from the 4-liter jug into the 3-liter jug. Now fill the 4-liter jug again from the 10-liter jug. 6. He either buys 1 cow, 4 sheep, 15 pigs, and 80 chickens, or he buys 4 sheep, 26 pigs, and 60 chickens. 7. The statement cannot be true, for if it were, then it would be false by its own admission and thus would be both true and false at the same time. On the other hand, it cannot be false, for if it were false, then it would be stating the truth and so would be both false and true at the same time. Thus, the statement is neither true nor false. 8. No, it is not possible. 9. Everything is fine through the end of step 6. But we cannot go from there to step 7, for it is not generally true that if $a^2 = b^2$, then $a = b$. For example, $4^2 = (-2)^2$, but $4 
eq -2$. 10. Old high school principals never die. They just lose their faculties. 11. In the problem on the left, we must also multiply 1/2 by 1/2. This gives us the 1/4 share which we need. 12. 11:00 p.m. last night. 13. I don’t know how many solutions are possible, but it appears that there are many. One solution is 176 = 4 x 4 x (4 x 4 x 4 x 4). 14. He either buys 1 goat, 13 pigs, and 86 chickens, or he buys 4 goats, 4 sheep, and 14 chickens. 15. Nothing. There aren’t that many people in the world. 16. Fill the 4-liter jug (from the 10-liter jug) twice, each time dumping the water from it into the 7-liter jug. 17. He is slow to wrath is of great understanding, but he that is hasty of spirit exalts folly. 18. Let G = a good guy, B = a bad guy. Solution to (a): Five round trips are needed. 1) Either G and B go over and G comes back, or B and G go over and B comes back. 2) B and G go over; B comes back. 3) G and G go over; G and B come back. 4) G and B go over; G comes back. Finally, B and G go over. Solution to (b): Let B = the bad guy who can row. Six round trips are needed: 1) Either G and B go over and G comes back, or B and G go over and B comes back. 2) B and G go over; B comes back. 3) G and G go over; G and B come back. 4) G and B go over; G and B come back. 5) G and G go over; G comes back. Finally, B and G go over. 19. 20c. In effect, we are writing the left-hand number as a base two numeral. In the example given, 13, 4, 1101, 1 = (1 x 2) + (1 x 2) + (1 x 2) = (1 x 1) x (1 x 2) = (1 x 2) (1 x 2) = (1 x 1) (1 x 2). We then take the 1101, 1 and 1001, 1 from right to left, and then compare them with the numbers in the left column of the example. There are four digits in 1101, 1 and four numbers in the left column. The second number in the left column is carried out (corresponding to the 0 in 1101, 1) 1101, 1 = (1 x 2) + (1 x 2) + (1 x 2) + (1 x 1) x (1 x 2) = (1 x 2) (1 x 2) = (1 x 1) (1 x 2). We may then compare them with the numbers in the left column of the example. There are four digits in 1101, 1 and four numbers in the left column. The second number in the left column is carried out (corresponding to the 0 in 1101, 1) 1110, 1 = (1 x 2) + (1 x 2) + (1 x 2) + (1 x 1) x (1 x 2) = (1 x 2) (1 x 2) = (1 x 1) (1 x 2). This makes a remainder number of 0 remainder, and an odd number has a 1 remainder. 20. In the same way, we were multiplying the original right-hand number by 1, then by 2, then by 4, then by 8. In the example given, we ended up ignoring the multiplication by 2, leaving us to add the multiplications by 1, 4, and 8. But as we know from the distributive principle, 1 x 18 + 4 x 18 + 8 x 18 = (1 + 4 + 8) x 18 = 13 x 18, the original problem.
1.

Six bottle caps start out in the triangular shape shown in Figure 1. They are to be moved into the six-sided shape shown in Figure 2.

To move a cap, you must slide it so that it does not disturb any other cap and so that it ends up touching two other caps. The caps must stay flat on the surface at all times.

Can you rearrange the caps as required, using only four moves?
2.

If you buy a goat for $20, sell it for $40, buy it back again for $60, and sell it again for $80, how much money have you gained or lost on the combined deals?
3.

You have a very large sheet of paper. The paper is only 1/400th of a cm thick—that is, a pile of 400 sheets is only 1 cm high. You tear the sheet in half and put one piece on top of the other. You tear both pieces in half and pile up the four sheets. You do it a third time and pile up the eight sheets. You keep tearing and piling until you've done it fifty times.

About how high is the final stack (Take a guess — 5 or or 10 cm? a meter? 10 meters? 50 meters? how many?)
4.

Use the letters underneath to fill in the chart so that words are formed and the quotation makes sense. A shaded space in the chart shows the end of a word. (The end of a line in the chart is not necessarily the end of a word.)
5.

You have a 10-liter jug full of water. You also have an empty 4-liter jug and an empty 3-liter jug. All the jugs are unmarked. Using only these jugs, how can you pour the water back and forth so that you end up with 5 liters of water in the 10-liter jug, 1 liter of water in the 3-liter jug, and 4 liters of water in the 4-liter jug?
6.

A farmer buys 100 live animals for $100. How many of each does he buy if chicks are 10¢ each, pigs are $2 each, sheep are $3 each, and cows are $50 each?
7.

Is the following statement true, or is it false?

THIS STATEMENT IS FALSE.
8.

Can you arrange the numbers 1-10 on the points of intersection so that the four numbers on each full segment total 22?
9.

ARE YOU AS OLD AS METHUSELAH?

Let \( x \) = Methuselah’s age, let \( y \) = your age, and let \( s = x + y \). Then

1) \( x + y = s \)

2) \( (x + y)(x - y) = s(x - y) \)

3) \( x^2 - y^2 = sx - sy \)

4) \( x^2 - sx = y^2 - sy \)

5) \( x^2 - sx + \frac{s^2}{4} = y^2 - sy + \frac{s^2}{4} \)

6) \( (x - \frac{s}{2})^2 = (y - \frac{s}{2})^2 \)

7) \( x - \frac{s}{2} = y - \frac{s}{2} \)

8) \( x = y \)

So you are as old as Methuselah.

What’s wrong?
10.

Use the letters underneath to fill in the chart so that words are formed and the quotation makes sense. A shaded space in the chart shows the end of a word. (The end of a line in the chart is not necessarily the end of a word.)
11.

We know that \( \frac{1}{2} = .5 \), so if we multiply \( 24\frac{1}{2} \) by \( 18\frac{1}{2} \), we have to get the same answer as if we multiply 24.5 by 18.5, right? Well, let's try it and see.

\[
\begin{array}{c}
24\frac{1}{2} \\
\times 18\frac{1}{2} \\
\hline
192 \\
24 \left(24 \times 18\right) \\
12 \left(\frac{1}{2} \text{ of } 24\right) \\
9 \left(\frac{1}{2} \text{ of } 18\right) \\
\hline
453 \text{ answer}
\end{array}
\]

\[
\begin{array}{c}
24.5 \\
\times 18.5 \\
\hline
12.25 \left(24.5 \times .5\right) \\
196.0 \left(24.5 \times 18\right) \\
245 \\
\hline
453.25 \text{ answer}
\end{array}
\]

So if the answers have to be the same, then how come they're not?
12.

A certain kind of bacteria doubles in quantity every hour. At midnight two nights ago, only two of these bacteria were in a jar. At midnight last night, the jar was full. At what time was the jar half full?
13.

How many ways can you find to write 176, using exactly eight 4's?
14.

A farmer buys 100 live animals for $100. How many of each does he buy if chickens are 75¢ each, pigs are $2.50 each, and goats are $3 each?
15.

Suppose that 15 people get together and decide to start a chain letter* which reads like this:

Dear Friend,

Send $1 to the person whose name is at the top of the list. Then cross off the top name and put your name at the bottom of the list. Then make 4 copies of this letter with your name on the list and send these copies to 4 people you know. Eventually, for a $1 investment, you will be rich!

Also suppose that there are 15 names on the list, that you get your letter from one of the 15 originators, and that everybody does what the letter says unless the person has already received the letter.

Under these conditions, how much can you expect to receive in return for your $1 investment?

*Note: Chain letters such as the one described above are illegal in the United States.
16.

You have a 10-liter jug full of water. You also have an empty 4-liter jug and an empty 7-liter jug. All the jugs are unmarked. Using only these jugs, how can you pour the water back and forth so that you end up with 5 liters of water each in the 10-liter jug and in the 7-liter jug?
17.

Use the letters underneath to fill in the chart so that words are formed and the quotation makes sense. A shaded space in the chart shows the end of a word. (The end of a line in the chart is not necessarily the end of a word.)
18.

Three good guys and three bad guys were running from a forest fire. They came to a river full of crocodiles. There was a boat at the shore. The men had to get to the other side to get away from the fire. They all had to go in the boat so the crocodiles wouldn't get them. But the boat was big enough to hold only two men at a time. If there were ever more bad guys than good guys on (or near) one side of the river, then the bad guys there would kill the good guys there. The boat did not have a motor, but it had two oars.

How did all six men get across the river safely if
a) all six men could row?
b) all three good guys could row, but only one bad guy could row?
19.

You buy a large bottle of pop for $1.50, including the bottle deposit. The pop costs $1.10 more than the bottle.

How much deposit return should you get when you take the bottle back?
20.

PEASANT MULTIPLICATION

This is a way to multiply any two numbers without having to know how to multiply or divide by any number except 2.

1) Choose any two numbers you want to multiply together. Write them down side by side.
2) Divide the number on the left by 2. Ignore the remainder if you have one. Write the quotient underneath the number you divided. Multiply the number on the right by 2. Write the answer underneath the number you multiplied.
3) Keep repeating step 2 until the number on the left is 1.
4) Now look at each pair of numbers. If the number on the left is even, then cross both numbers out. If it is not even, then leave the numbers alone. (Do this for each pair.)
5) Now add all the numbers on the right which are not crossed out.

Example: Multiply 13 by 18.

\[
\begin{array}{c}
13 \\
-6 \\
3 \\
1 \\
\hline
18 \\
-36 \\
72 \\
144 \\
\hline
234
\end{array}
\]

The final answer is the product of the original two numbers. How come?

Hint 1: We can see that the answer is not, "Because we took half of one side and doubled the other side, so it has to work." If that were the answer, then the final line—\(1 \times 144 = 144\) — would be the answer in the example. Besides that, we ignored remainders, and we couldn’t do that if we were really taking half of one side and doubling the other.

Hint 2: The answer to the question has something to do with base two numerals.
21.

Tickets to a benefit are priced as follows: children, 50¢ each; men, $2 each; women, $3 each. Find all the ways in which 100 people may purchase tickets (legitimately) for $100.
22.

Three utility companies want to run connecting lines to three houses.

A. How can they do it, if they must obey the following regulations?
   1) A utility cannot run a line through another utility or along with another utility's line.
   2) Looking at the drawing, a utility cannot run a line through a house. (The line must stop when it gets to the house.)
   3) Looking at the drawing, no line may cross another line.
   4) Each connection must be made directly. That is, a line may not run from a utility to a house and then from that house to another house.

B. Does your answer change if you are allowed to position the houses and utilities in any way you wish?
23.

Use the letters underneath to fill in the chart so that words are formed and the quotation makes sense. A shaded space in the chart shows the end of a word. (The end of a line in the chart is not necessarily the end of a word.)
24.

SUPER CHALLENGE

You have thirteen balls, all of which look the same and are the same size. Twelve balls weigh exactly the same, but the other one has a different weight. You have a pan balance.

Tell how to find the odd ball in just three weighings.
25.

An 8 x 8 square is cut out as shown in Figure 1. It then appears that the pieces can be rearranged to form a triangle as shown in Figure 2.

The area of the square is 64 (that is, side x side, or 8 x 8). But the area of the triangle seems to be 65 (that is, \( \frac{1}{2} \) of base x height, or \( \frac{1}{2} \times 10 \times 13 \)).

How is it possible for the same four pieces (A, B, C, and D) to have two different total areas?
26.

Read the symbols and figure out the message.

Example: Message: K, U R YY.
Solution: Kay, you are wise.

DUU AES D-V-S?
E-S, NES ATT-R, 2.
Y DUU AA O?
EE T-LL N E-L I, 2.
O, I C.
DU?
O, E-S.
27.

One letter (which may be used several times) is missing from the letters below. Insert this letter everywhere it is needed, along with spaces and punctuation, to make a sentence.

Example: Problem: theueenuicklyuestioned theuietuarterback
Solution: The queen quickly questioned the quiet quarterback.

TEEIRTOTETRONEDIGOPESFORISEAL TYORSE
28.

How many squares are here?
29.

Two trains are 150 kilometers apart and are heading toward each other along a single track. The first train is going 90 kilometers an hour. The second train is going 60 kilometers an hour. Flying at a constant speed of 110 kilometers an hour, a bird takes off from the head of the first train, flies to the head of the second, immediately turns and flies back to the head of the first, immediately turns and flies back to the head of the second, and keeps going like this until the two trains crash. How far does the bird fly?
GEOMETRY PUNS

1. Steve was playing against the New York Mets. After tricking him into trying to steal second base and then tagging him out as he slid in, he looked up at the second baseman and said, "__________________"

2. What do we call an aircraft which is only half there?

3. Kinte's new puppy, Indi, chewed up his geometry homework paper just before Kinte had to leave for school. What did Kinte say when his teacher asked why he didn't have his homework that day?

4. What did the housewife say to the mirror as she held the kitchen strainer in front of it?

5. Joe Wilson built a small fenced-in area in his back yard for his 17 cats. When his friend, Dick Uler, asked him what he called it, Joe said, "It's a _________________."

6. What is a thick-headed triangle called?

7. A new little kid on the block, Perim, was always picking fights with the other kids. One day, Julie ran home crying. Her little sister, Ruth, told their mother, "__________________"

8. Two photographers were taking pictures of wild birds. One said, "Oh, there's a beauty!" "Where?" said the other one. "Look right there," said the first, as he pointed. "___________ the leaves in that tree.""

9. What do we call an extremist?

10. What kind of dances did the Cubans do on the TV show?

11. What did Juan say as he showed his friend the tree he planted?

12. Luke and Thomas were watching a machine move along the cotton fields. Luke said, "That's a weeder." Thomas said, "Either that _________________."

13. Ayshun and Brubaker were writing back and forth about a business deal. There were a few points unsettled, however, and Brubaker sent Ayshun a letter about one of these points, P. At the end of the day, Brubaker wrote in his business diary, "__________________"

14. What did the student say about the teacher who was always impartial?

15. What did Sam say when the train was overdue?

16. What did the woman say when she jostled someone in the elevator?