WHAT DO YOU DO WHEN A RICH MATH PROBLEM GOES SIDEWAYS?

ROBERT KAPLINSKY

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robertkaplinsky.com/sideways

@robertkaplinsky



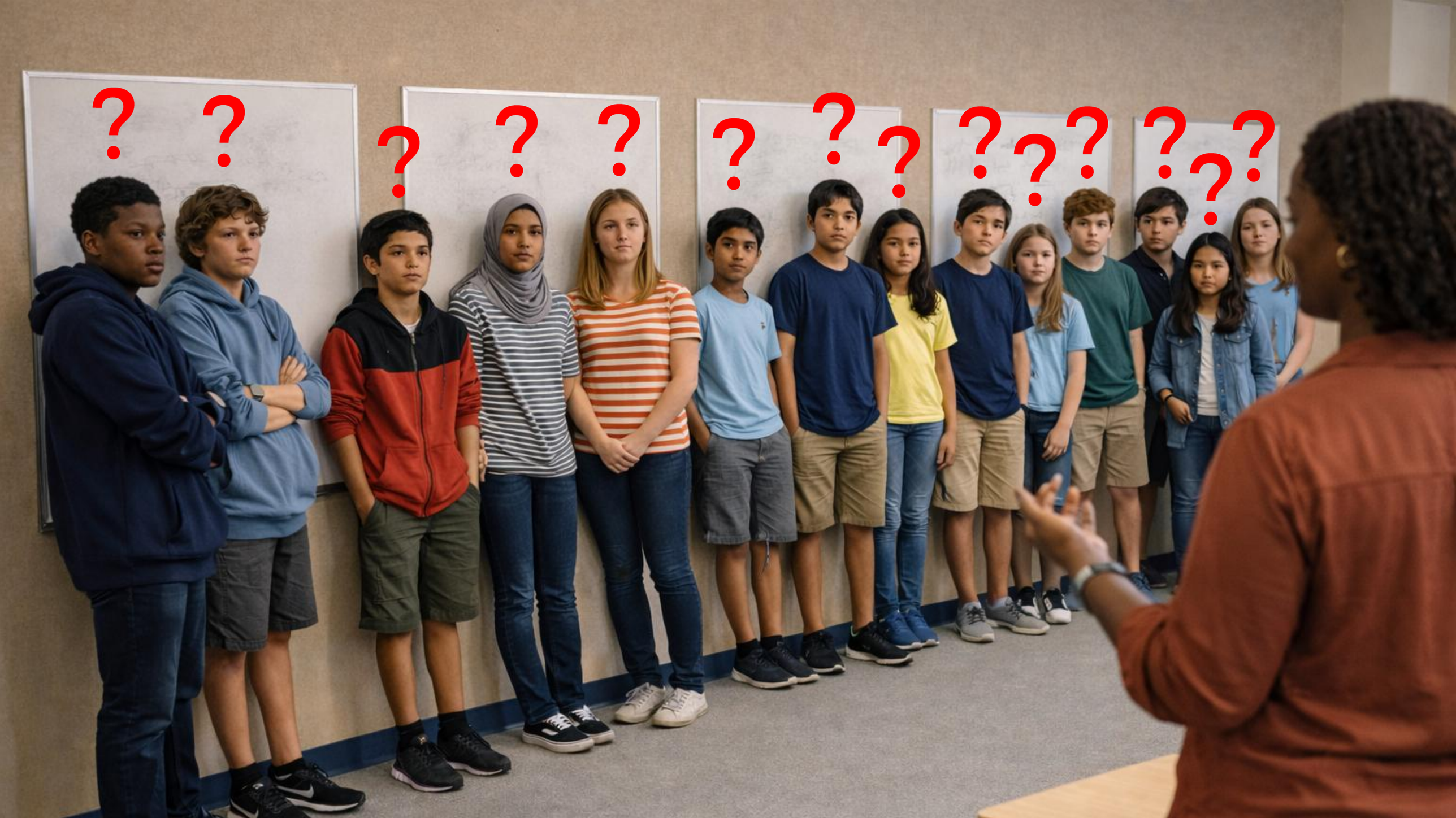
TOPICS

- ❑ HOW SHOULD WE MEASURE A LESSON'S SUCCESS?
- ❑ WHAT'S AN EXAMPLE WE CAN EXPLORE?
- ❑ WHAT ARE OUR FACILITATING OPTIONS?
- ❑ WHAT DOES THIS LOOK LIKE IN ACTION?
- ❑ CONCLUSION

correct answers

correct answers

growth

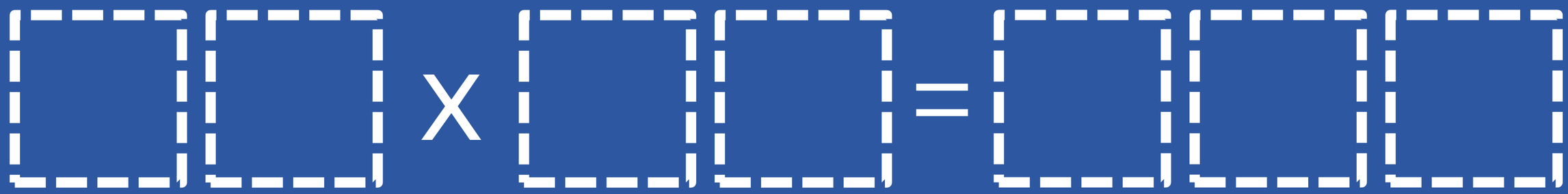




TOPICS

- [x] HOW SHOULD WE MEASURE A LESSON'S SUCCESS?
- [ ] WHAT'S AN EXAMPLE WE CAN EXPLORE?
- [ ] WHAT ARE OUR FACILITATING OPTIONS?
- [ ] WHAT DOES THIS LOOK LIKE IN ACTION?
- [ ] CONCLUSION

Using the digits 0 to 9 at most one time each, place a digit in each box to create a true equation with the greatest possible product.



Source: openmiddle.com

PARTS OF A MATH PROBLEM

- Beginning
- Middle
- End

Correct

-
-
-
-
-

Concerns

-
-
-
-
-



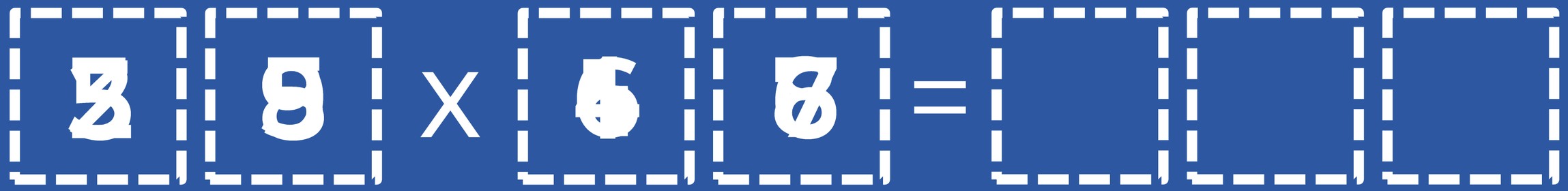

POLICE LINE DO NOT CROSS
POLICE DO NOT CROSS
POLICE LINE DO NOT CROSS
2
1
3
4

Correct

- Guess and check without conceptual understanding

Concerns

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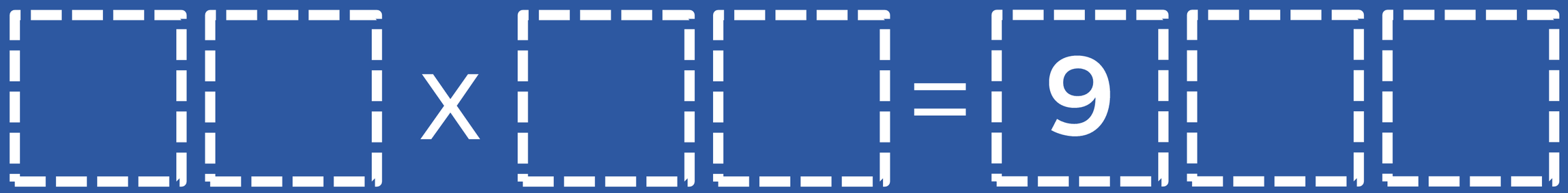
Source: openmiddle.com

Correct

- Guess and check without conceptual understanding
- Guess and check with conceptual understanding

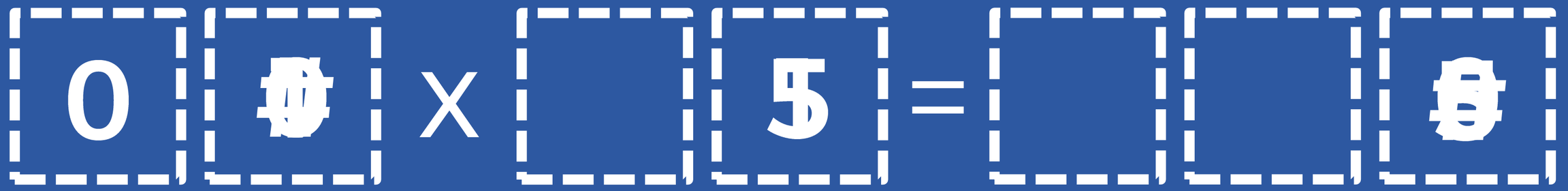
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Using the digits 0 to 9 at most one time each, place a digit in each box to create a true equation with the greatest possible product.



Source: openmiddle.com

Correct

- Guess and check without conceptual understanding
- Guess and check with conceptual understanding
- Division

Concerns

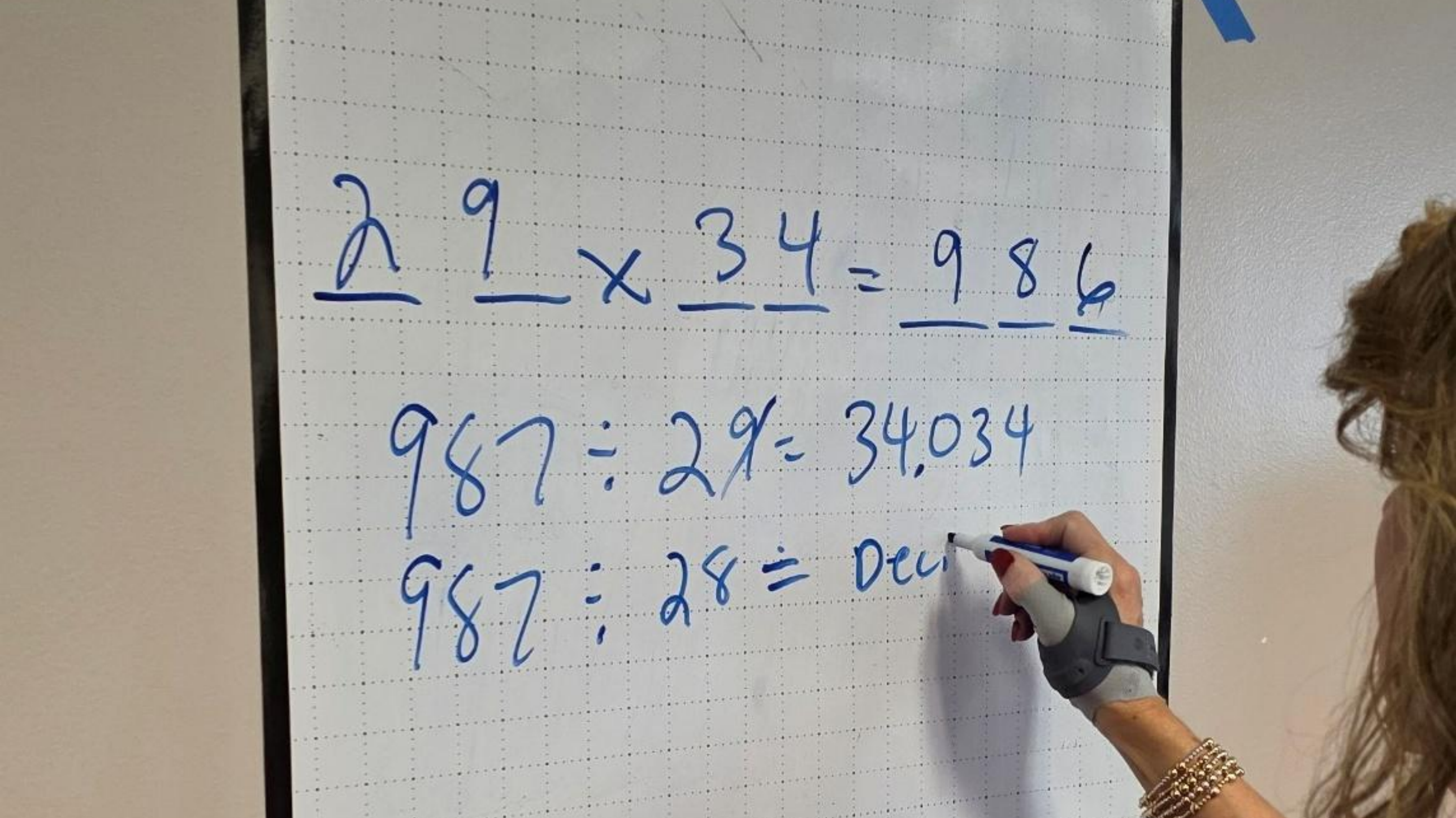
$$987 \div 53$$

$$987 \div 52$$

$$987 \div 51$$

$$987 \div 50$$

$$987 \div 49$$


29 x 34 = 986
987 ÷ 29 = 34.034
987 ÷ 28 = Dec

$\frac{435}{27} = 16.\overline{1}$

$\frac{972}{54} = 18$

$\frac{434}{27} = 16.14\overline{81}$

$\frac{438}{15} = 29.2$

$\frac{432}{19} = 23$

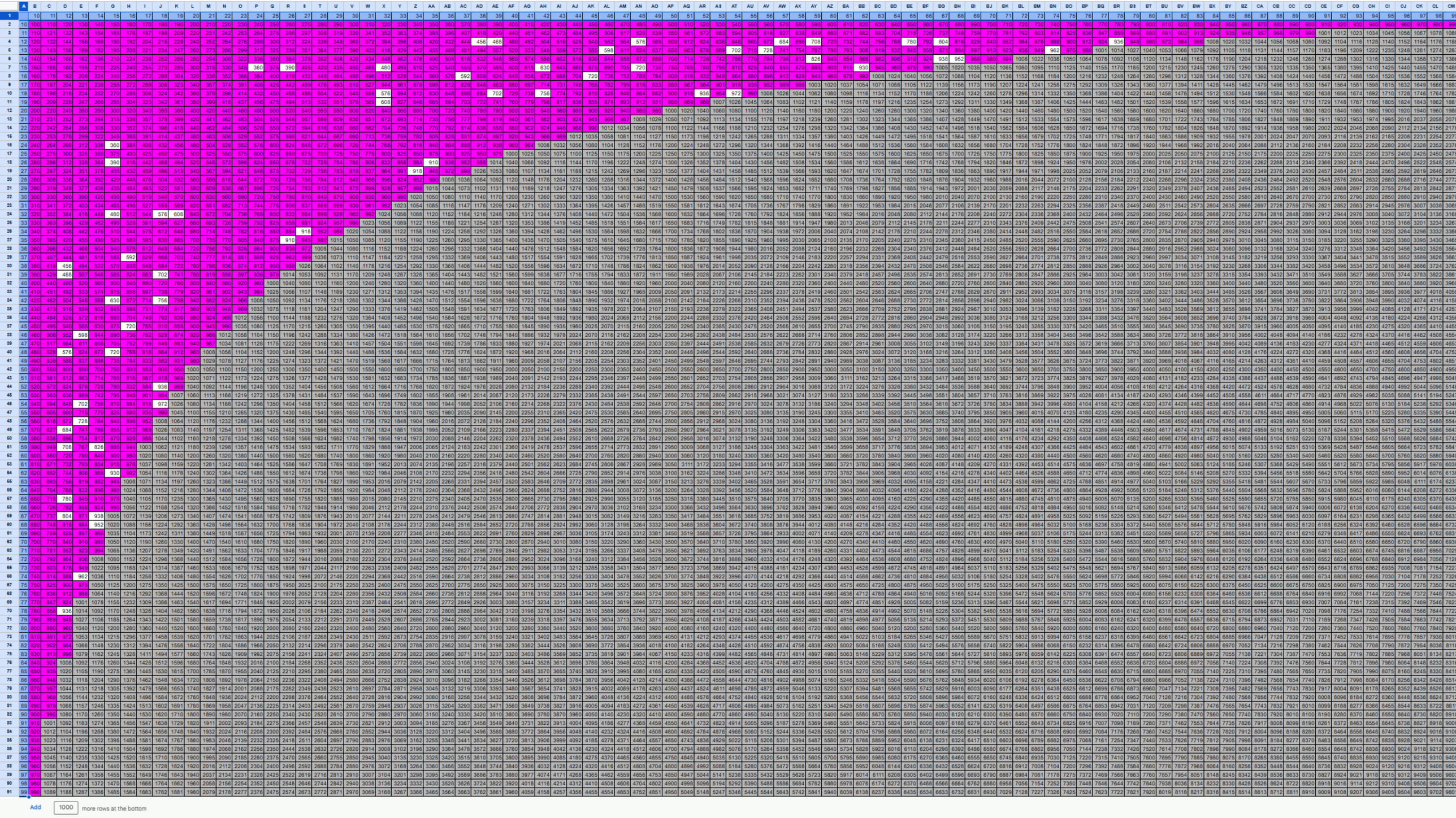
$\frac{438}{16}$ 27.3

$\frac{432}{16} = 27$

Correct

- Guess and check without conceptual understanding
- Guess and check with conceptual understanding
- Division
- Giant times table

Concerns



Add 1000 more rows at the bottom

930

936

938

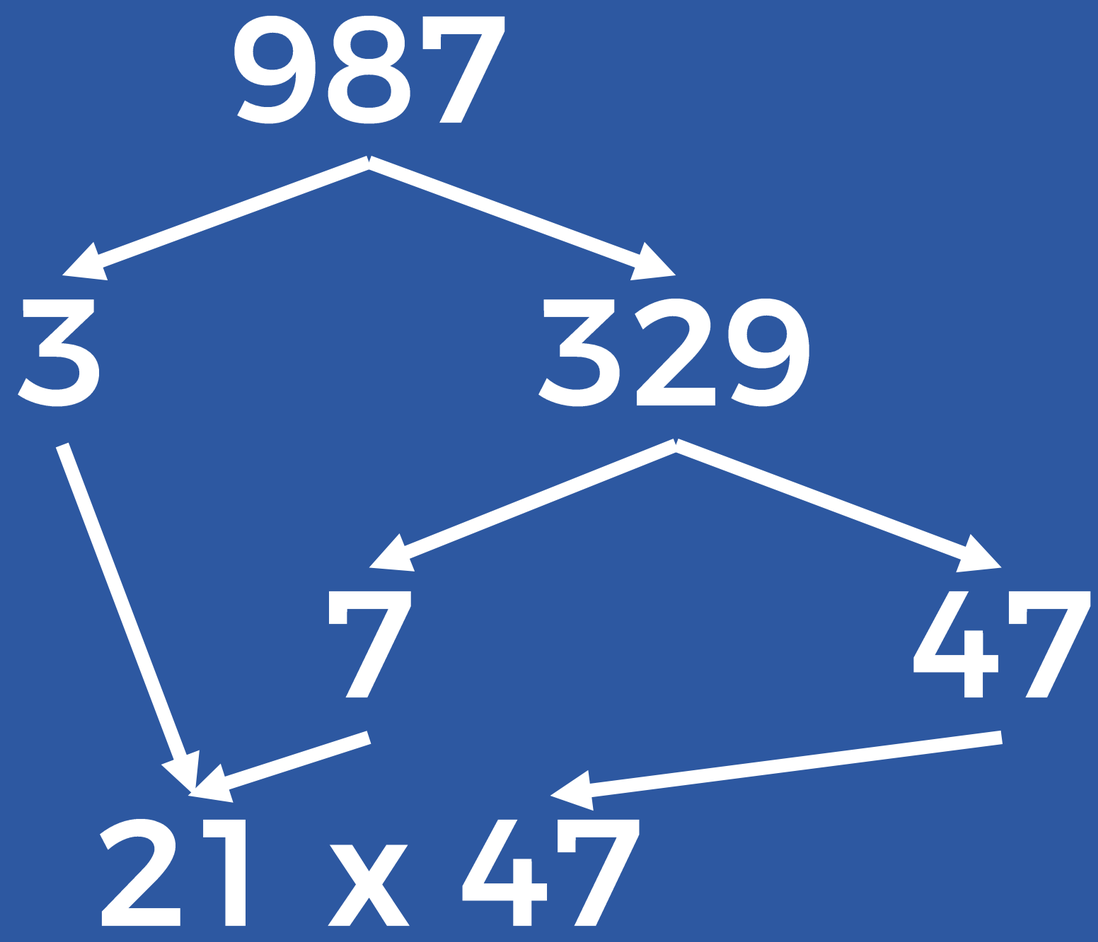
952

972

Correct

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- Prime factorization

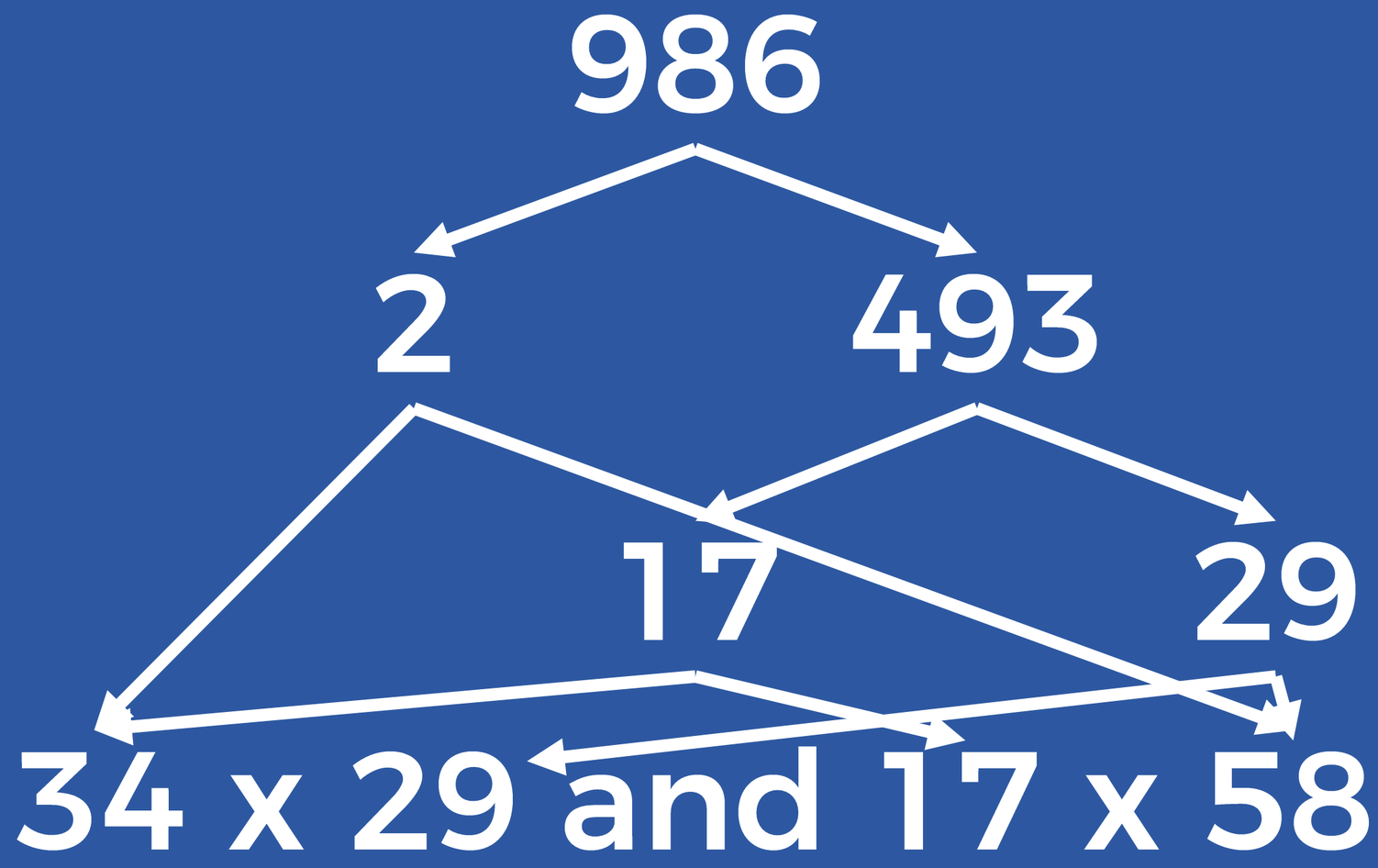
Concerns


987
3
329
7
47
21 x 47

Using the digits 0 to 9 at most one time each, place a digit in each box to create a true equation with the greatest possible product.



Source: openmiddle.com

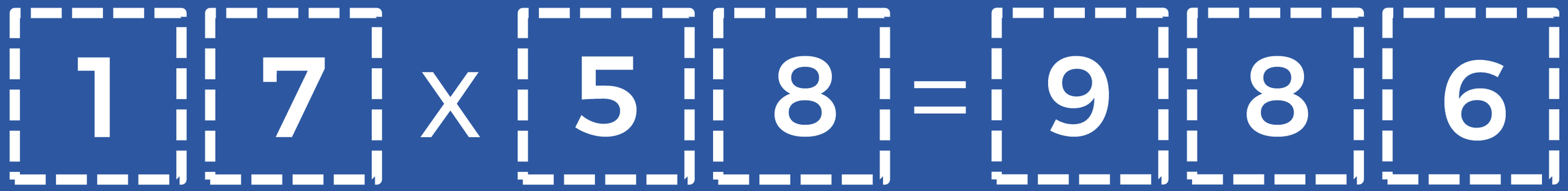

986
2
493
17
29
34 x 29 and 17 x 58

Using the digits 0 to 9 at most one time each, place a digit in each box to create a true equation with the greatest possible product.



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Using the digits 0 to 9 at most one time each, place a digit in each box to create a true equation with the greatest possible product.



Source: openmiddle.com

25·25=625

30·30=900

31·31=961

30·29=870

30·28=840

30·27=810

31·27=837

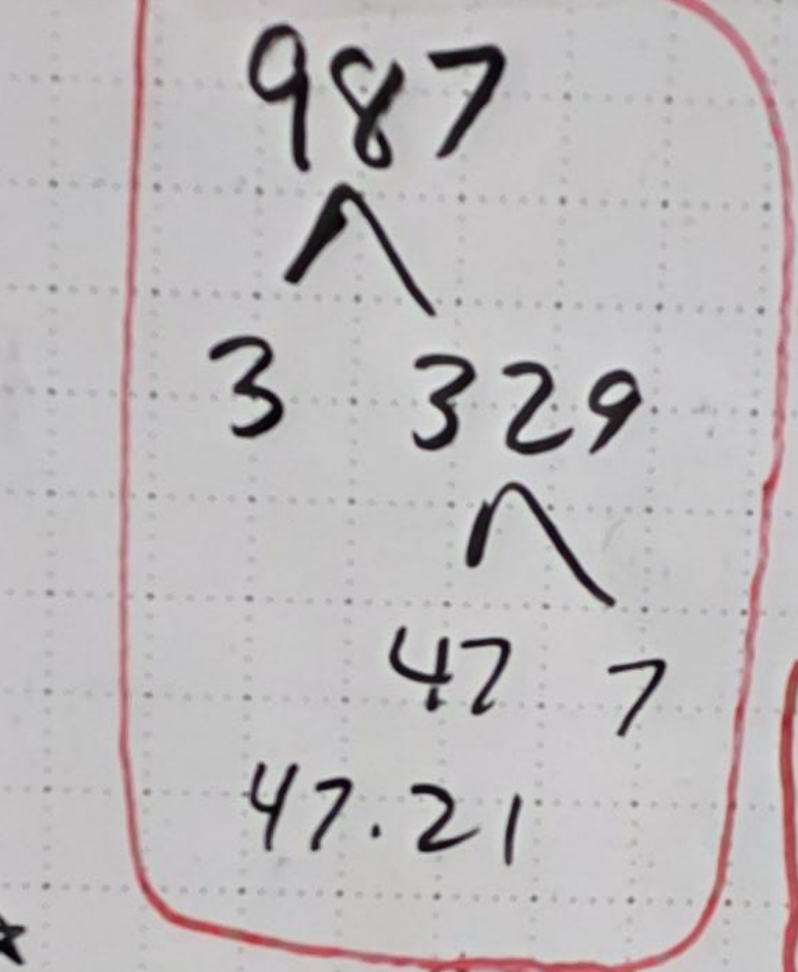
34·27=918 ★

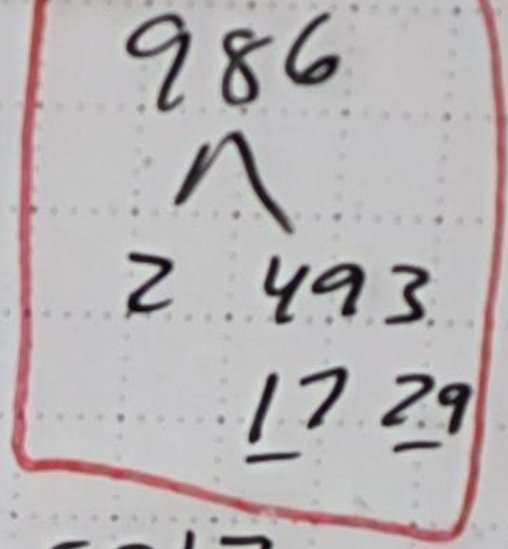
35·27

36·27=972

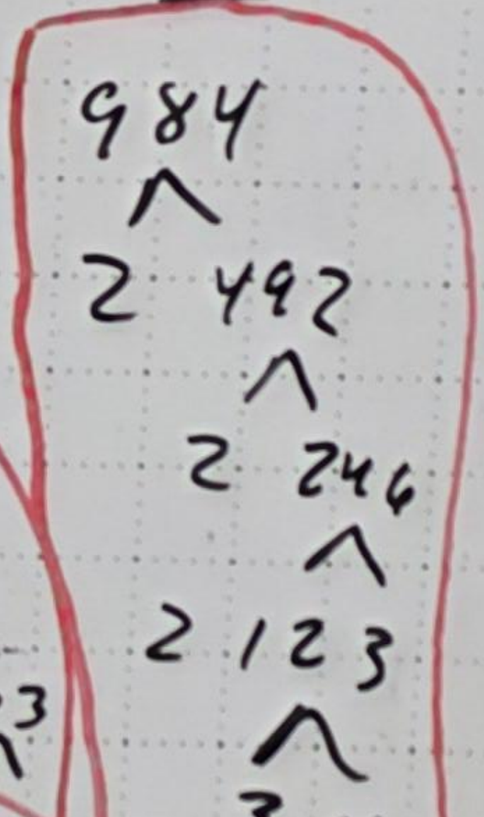
36·28=1008

36·24=864

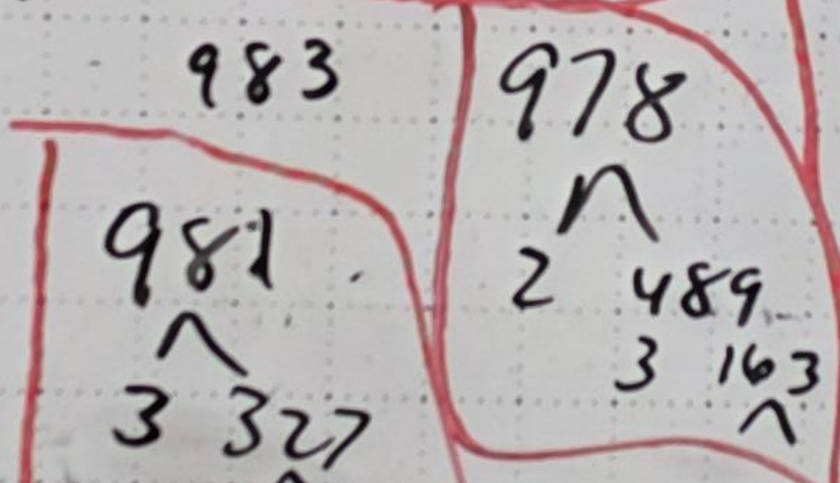




5817



983

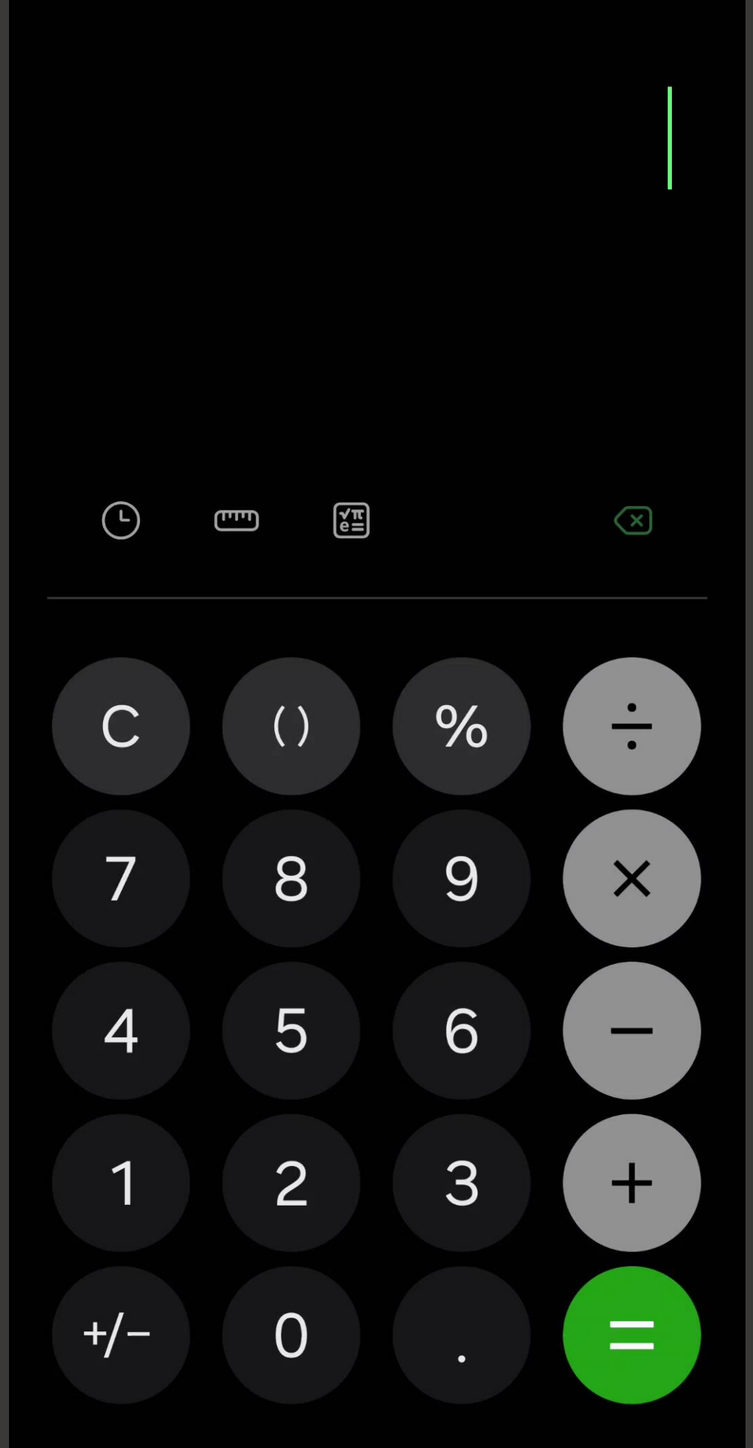


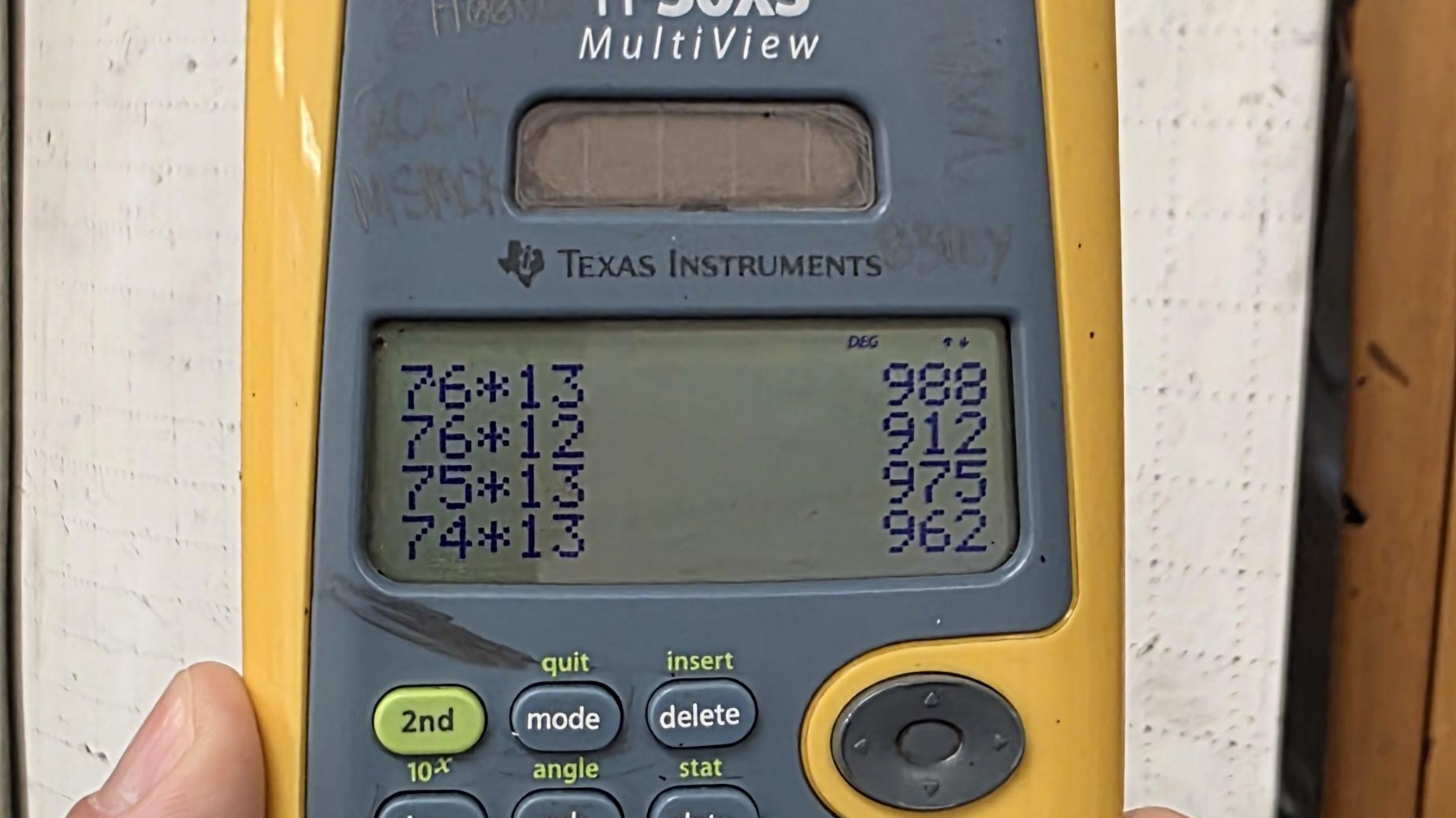
0 1 2 3 4 5 6 7 8 9

Correct

- Guess and check without conceptual understanding
- Guess and check with conceptual understanding
- Division
- Giant times table
- Prime factorization
- Strategic brute force with calculator

Concerns


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MultiView
TEXAS INSTRUMENTS
DEG
76*13
988
76*12
912
75*13
975
74*13
962
quit
insert
2nd
mode
delete
10^x
angle
stat

Correct

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Concerns

```
results = []

for a in range(10, 100):        # factor 1 (10 to 99)
    for b in range(10, 100):    # factor 2 (10 to 99)
        product = a * b         # multiply them
        if product < 1000:      # keep 999 or less
            results.append((a, b, product))
```

	A	B	C
1	Factor	Factor	Product
2	10	10	100
3	10	11	110
4	10	12	120
5	10	13	130
6	10	14	140
7	10	15	150
8	10	16	160
9	10	17	170
10	10	18	180
11	10	19	190
12	10	20	200
13	10	21	210
14	10	22	220
15	10	23	230
16	10	24	240
17	10	25	250
18	10	26	260
19	10	27	270
20	10	28	280
21	10	29	290
22	10	30	300
23	10	31	310
24	10	32	320
25	10	33	330
26	10	34	340
27	10	35	350

	A	B	C
1	Factor	Factor	Product
2	27	37	999
3	37	27	999
4	12	83	996
5	83	12	996
6	14	71	994
7	71	14	994
8	16	62	992
9	31	32	992
10	32	31	992
11	62	16	992
12	10	99	990
13	11	90	990
14	15	66	990
15	18	55	990
16	22	45	990
17	30	33	990
18	33	30	990
19	45	22	990
20	55	18	990
21	66	15	990
22	90	11	990
23	99	10	990
24	23	43	989
25	43	23	989
26	13	76	988
27	19	52	988

	A	B	C
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3	37	27	999
4	12	83	996
5	83	12	996
6	14	71	994
7	71	14	994
8	16	62	992
9	31	32	992
10	32	31	992
11	62	16	992
12	10	99	990
13	11	90	990
14	15	66	990
15	18	55	990
16	22	45	990
17	30	33	990
18	33	30	990
19	45	22	990
20	55	18	990
21	66	15	990
22	90	11	990
23	99	10	990
24	23	43	989
25	43	23	989
26	13	76	988
27	19	52	988

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Concerns

- Math issues
  - Students struggle with two-digit multiplication

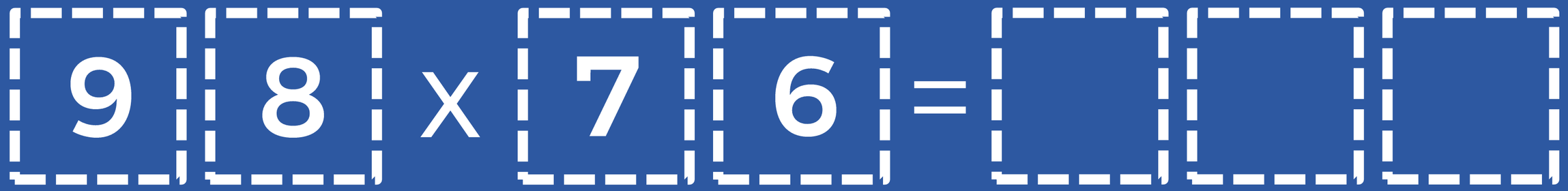
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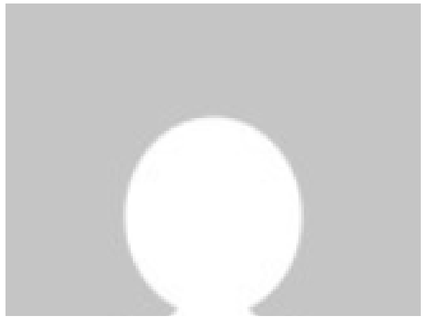
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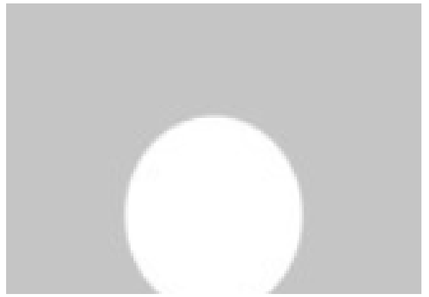
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  - Students use a digit more than once.





Melissa Marks

12 x 83 = 996

Miss. Shaw

12×83=996



MaTh KiNg !%$

nice, the biggest answers my class were 980 and 996



claire and Oscar

we did 11 x 11 = 121

ose

a solution of 83X12=996

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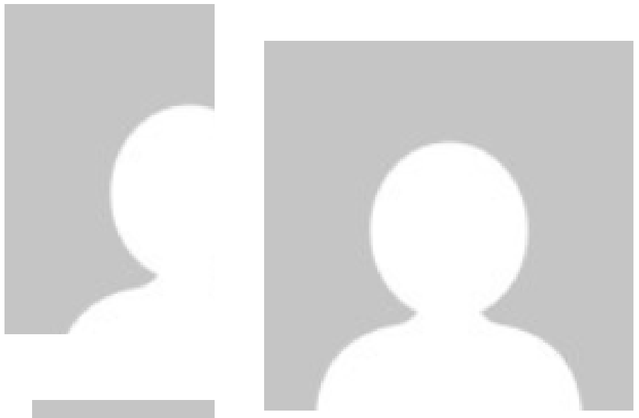
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Johnny Guzman

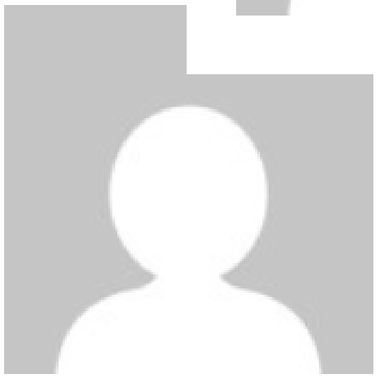
there is one greater 97 x 86 + 8342 or 98 x 76 + 8342



MaTh KiNg !%$

Also a bigger product will be 96×87=8352

Cordova



Rocco Burns **ybreak**

96 x 87 = 8,352 ound a higher product. 78 x 96 = 7488

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“The greatest possible product found so far is 62 x 15 which equals 930 but there may be one even greater. Let us know in the comments what you find.”

ROBERT KAPLINSKY



Eric

We found a higher product. 78 x 12 = 936



Amy Smith

My student and I found 18 x 54 =972 oh yea! We loved this one!



J. Kellams

We found 74×13=962

TOPICS

- [x] HOW SHOULD WE MEASURE A LESSON'S SUCCESS?
- [x] WHAT'S AN EXAMPLE WE CAN EXPLORE?
- [ ] WHAT ARE OUR FACILITATING OPTIONS?
- [ ] WHAT DOES THIS LOOK LIKE IN ACTION?
- [ ] CONCLUSION

When the cook tastes the soup, that's formative; when the guests taste the soup, that's summative.

BOB STAKE



less
understanding

more
understanding

more understanding ≠ correct answer

less understanding ≠ incorrect answer

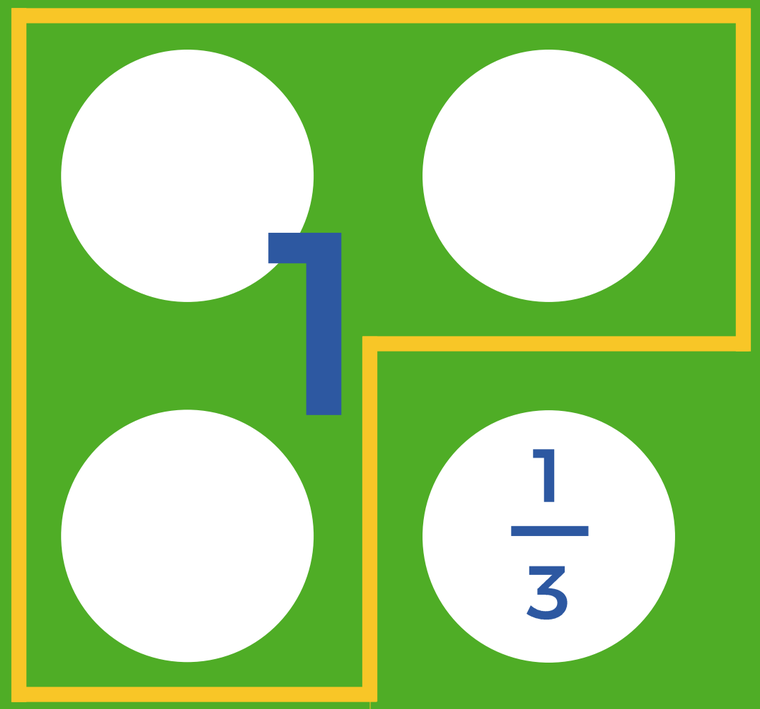
$$\frac{3}{4} \div \frac{1}{2}$$

$$\frac{3}{4} \times \frac{2}{1} = \frac{6}{4}$$

$$\frac{3}{2} = 1\frac{1}{2}$$

Why???

$$
\begin{array}{r}
1\frac{1}{3} \\
3\overline{)\,4} \\
-\,3 \\
\hline
1
\end{array}
$$



$\frac{1}{3}$

÷

÷

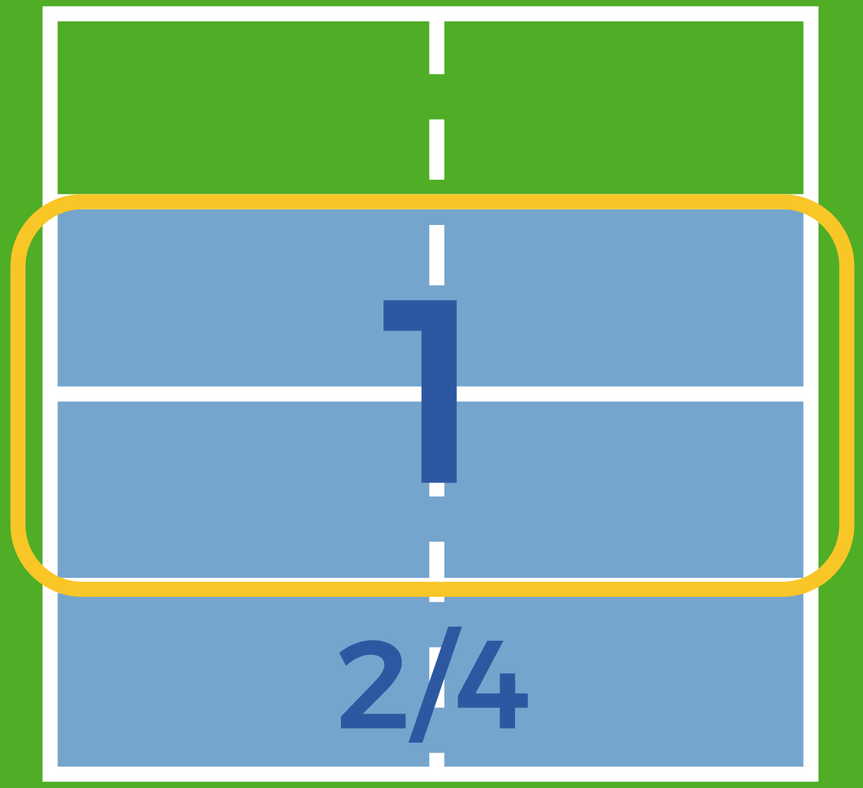
4

3

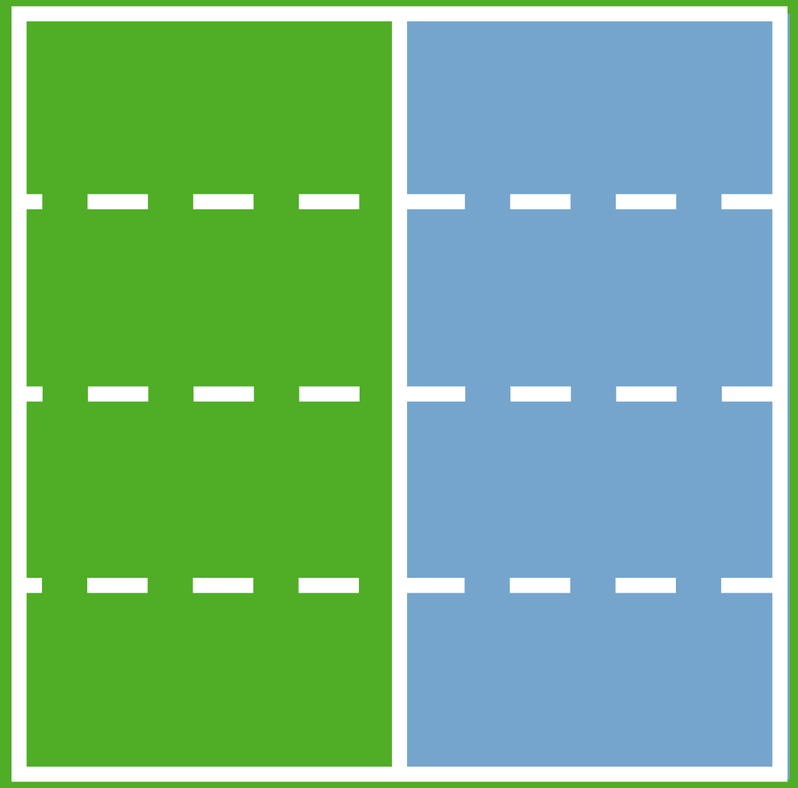
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÷



3/4 ÷ 1/2

more understanding ≠ correct answer

less understanding ≠ incorrect answer



less understanding

more understanding







DOUBLE-DOUBLE® *Double Meat & Double Cheese* 2.65

CHEESEBURGER 1.75

HAMBURGER 1.50

FRENCH FRIES 1.05

SHAKES *Chocolate Strawberry Vanilla* 1.55

SM	MED	LG	X-LG
99	1.10	1.29	1.49

COKE *Classic or Diet*
SEVEN-UP
ROOT BEER
DR PEPPER
LEMONADE
ICED TEA

MILK 70
COFFEE 70

OPEN 10:30 a.m. to 1:00 a.m.



$0.90

$0.90

$0.90

$0.90

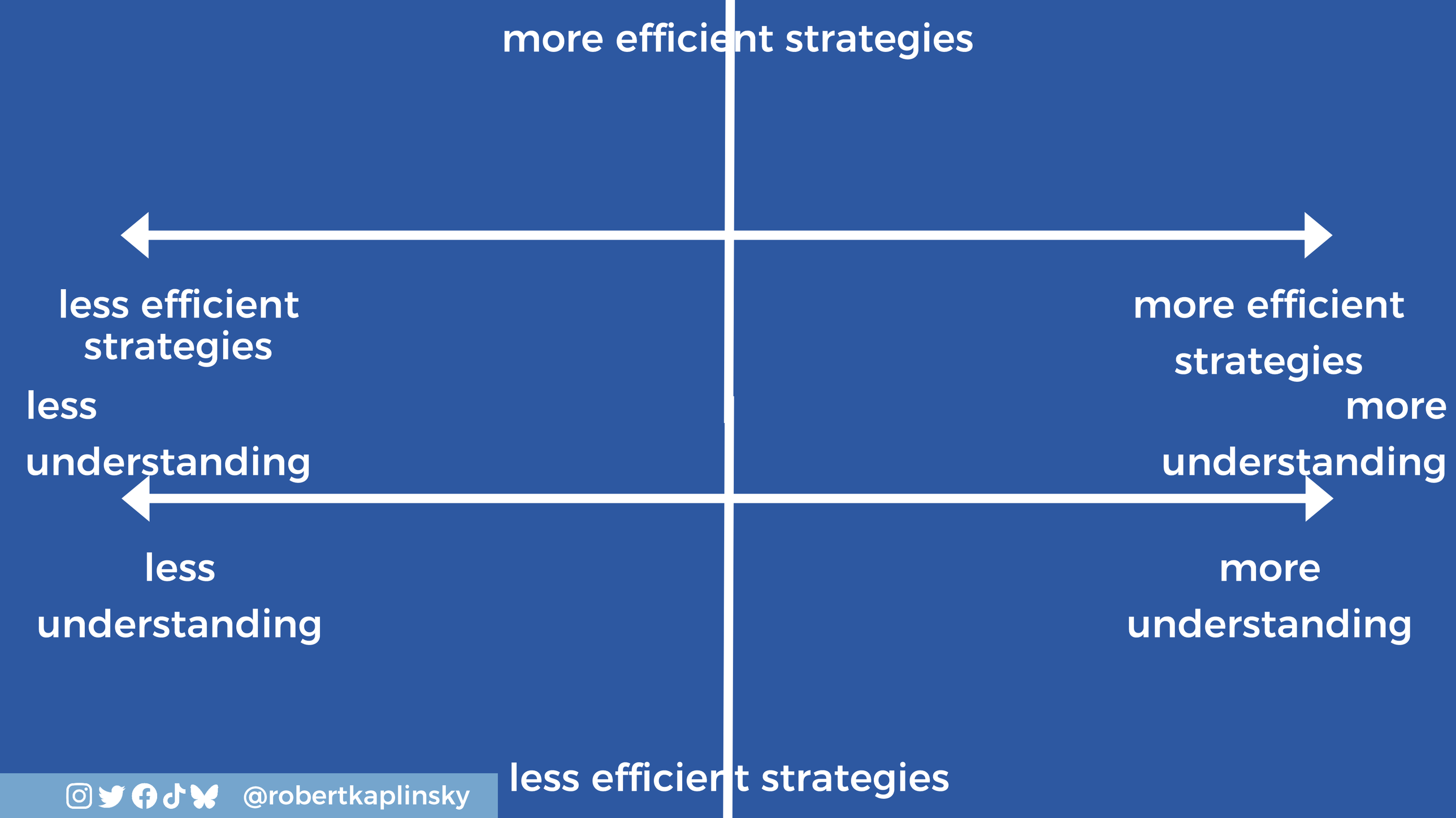
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$0.90

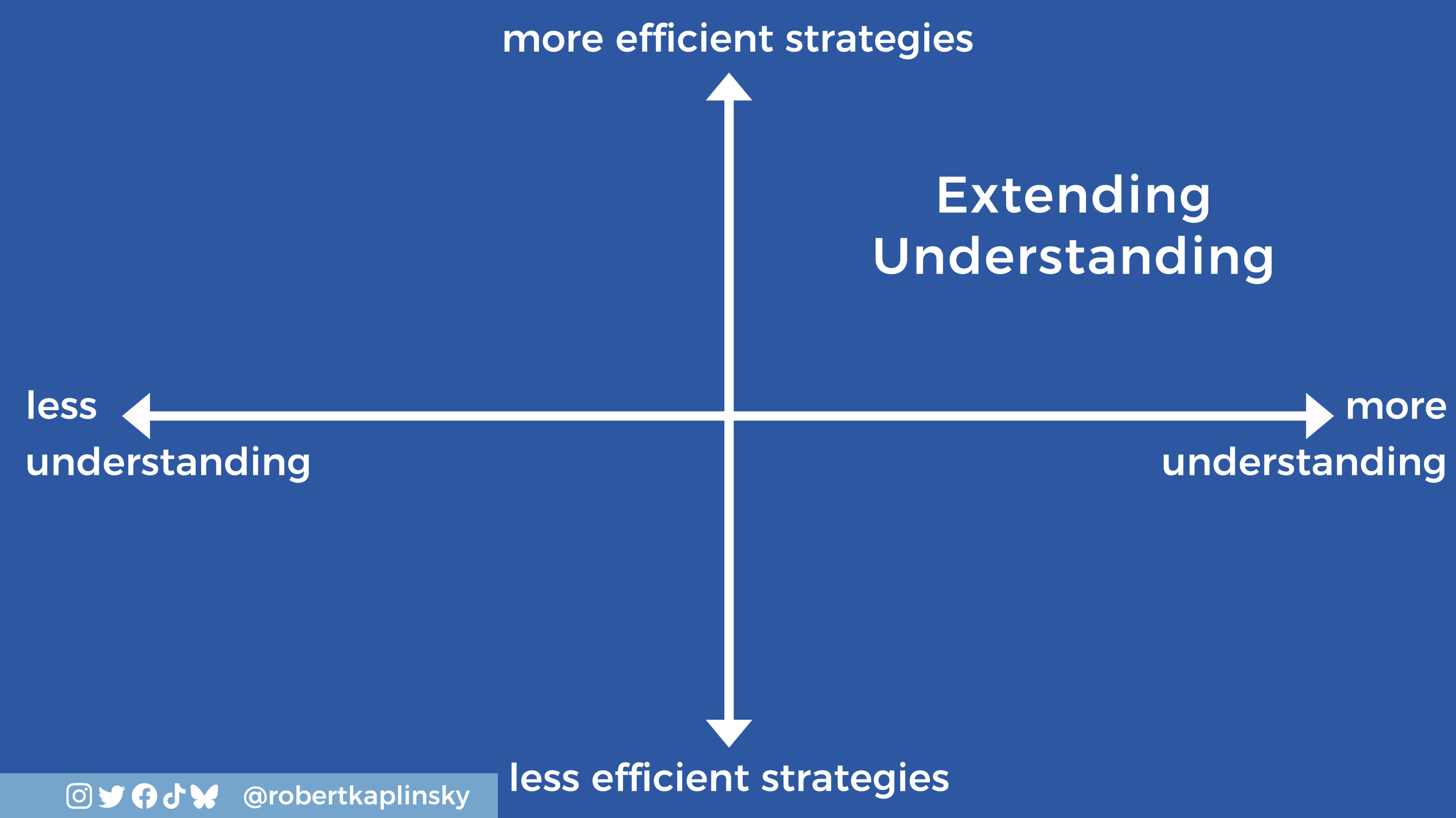
$0.90

$0.90

$1.75



@robertkaplinsky



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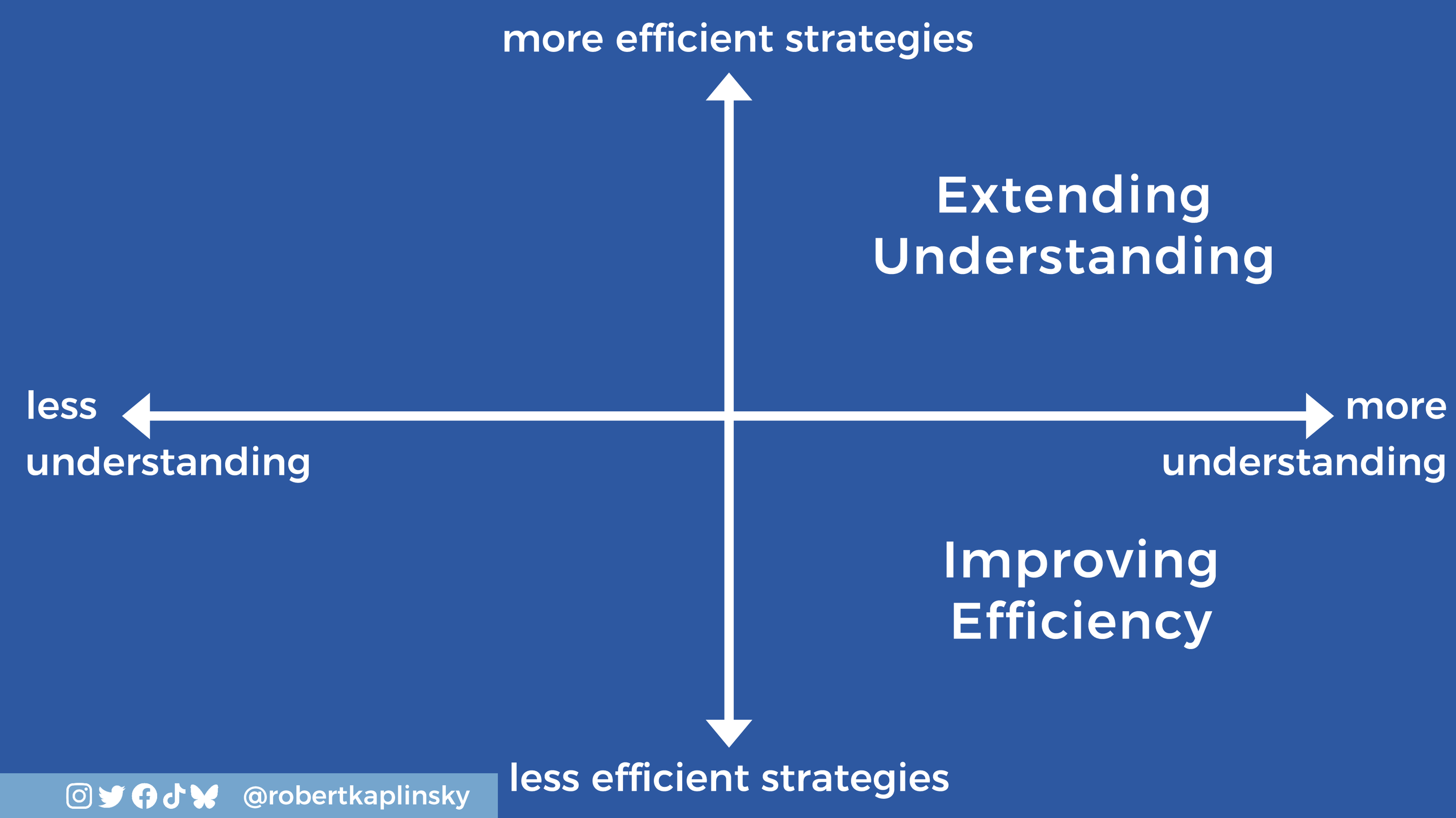


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Concerns

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@robertkaplinsky

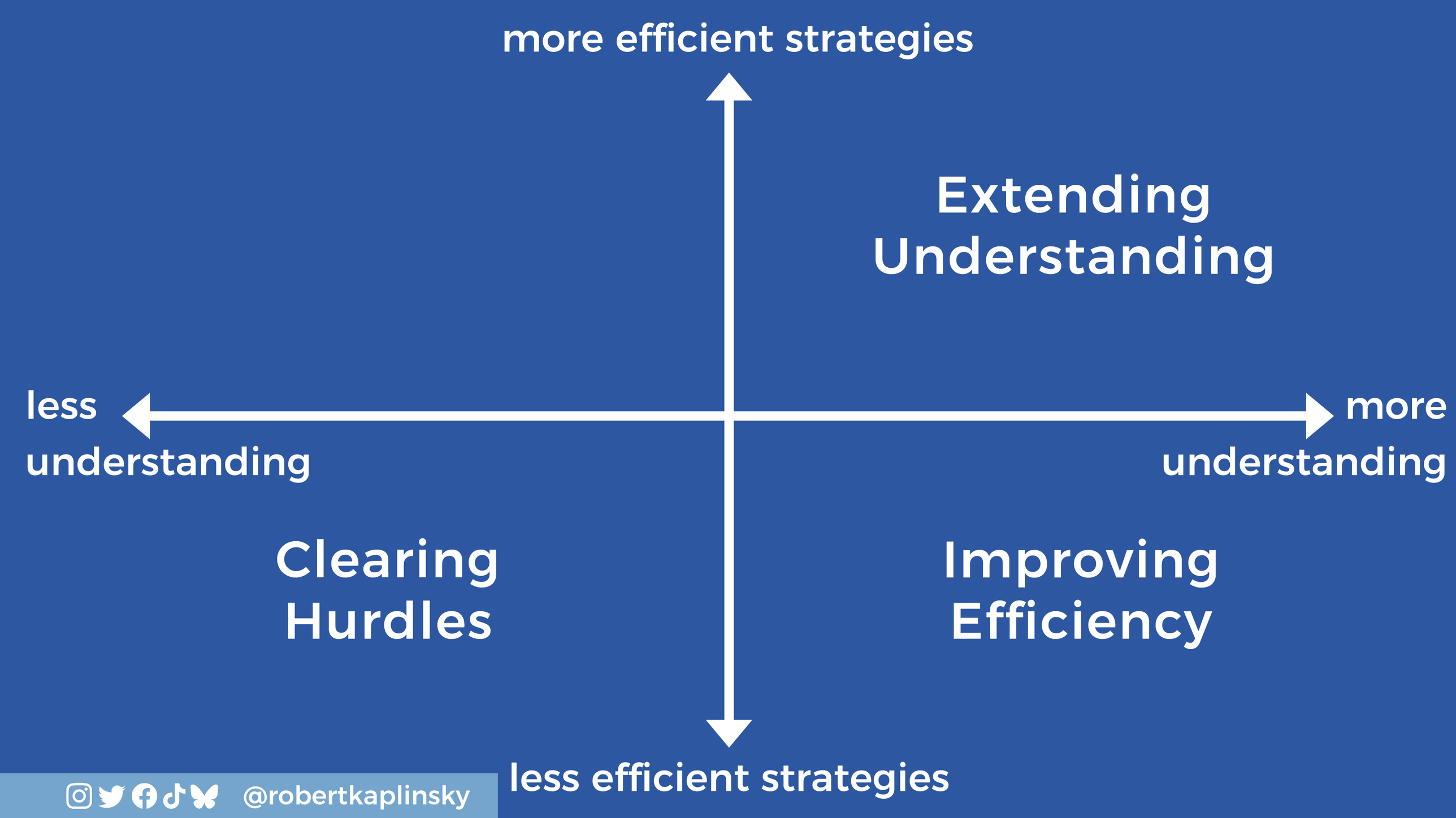


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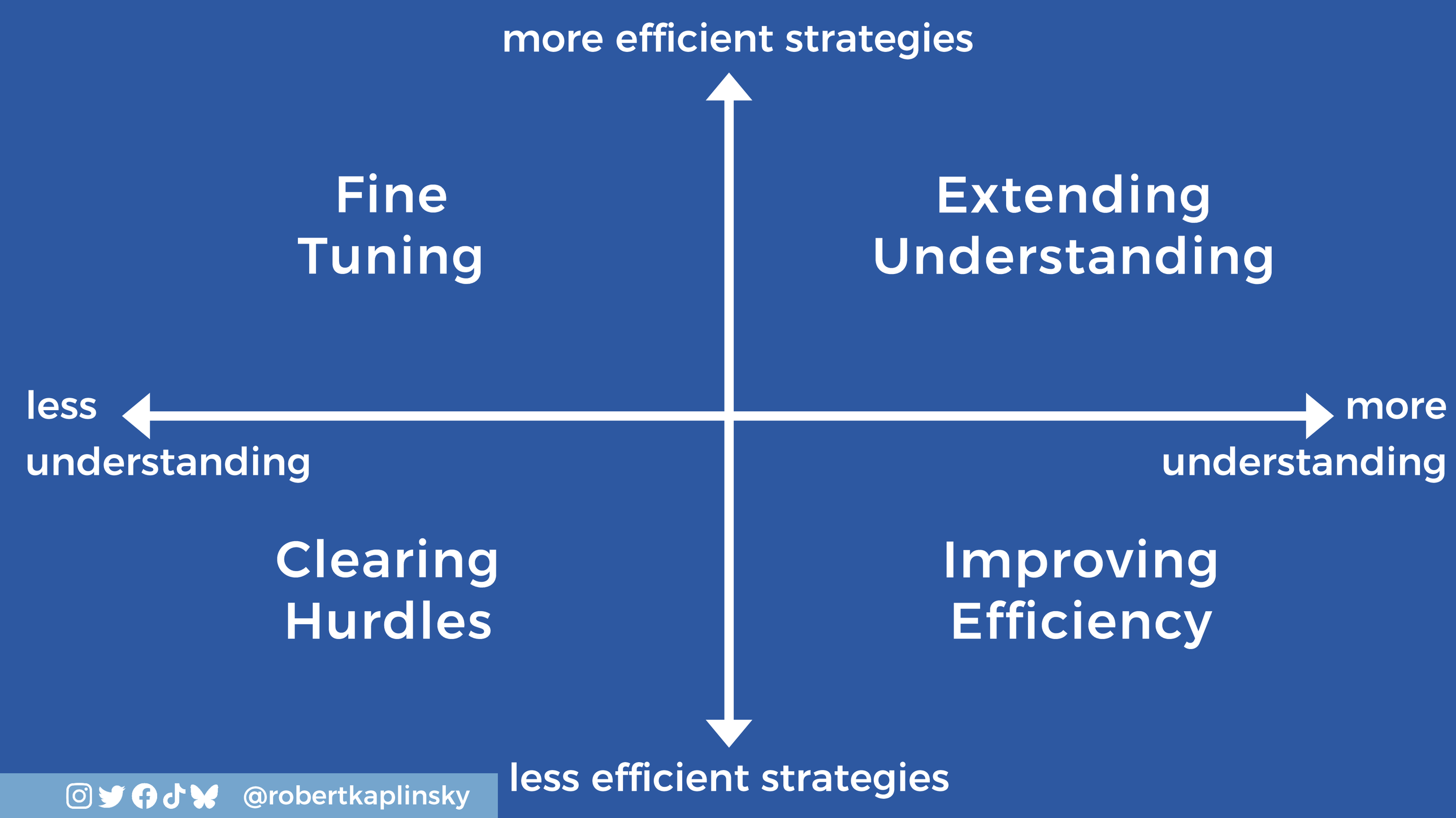
MY FAVORITE NO

- Pick a math error
- Share it with the class
- Ask “What in this problem am I happy to see?”
- Ask “Where’s the mistake?”

Source: Leah Alcala

A PROMPT YOU MIGHT USE

“Just like in a video game, everyone makes mistakes at first. What matters is learning from them so we do not repeat them and can go farther next time. Which mistake feels most useful to learn from?”



@robertkaplinsky



Correct

- Guess and check without conceptual understanding
- Guess and check with conceptual understanding
- Division
- Giant times table
- Prime factorization
- Strategic brute force with calculator
- Brute force with coding

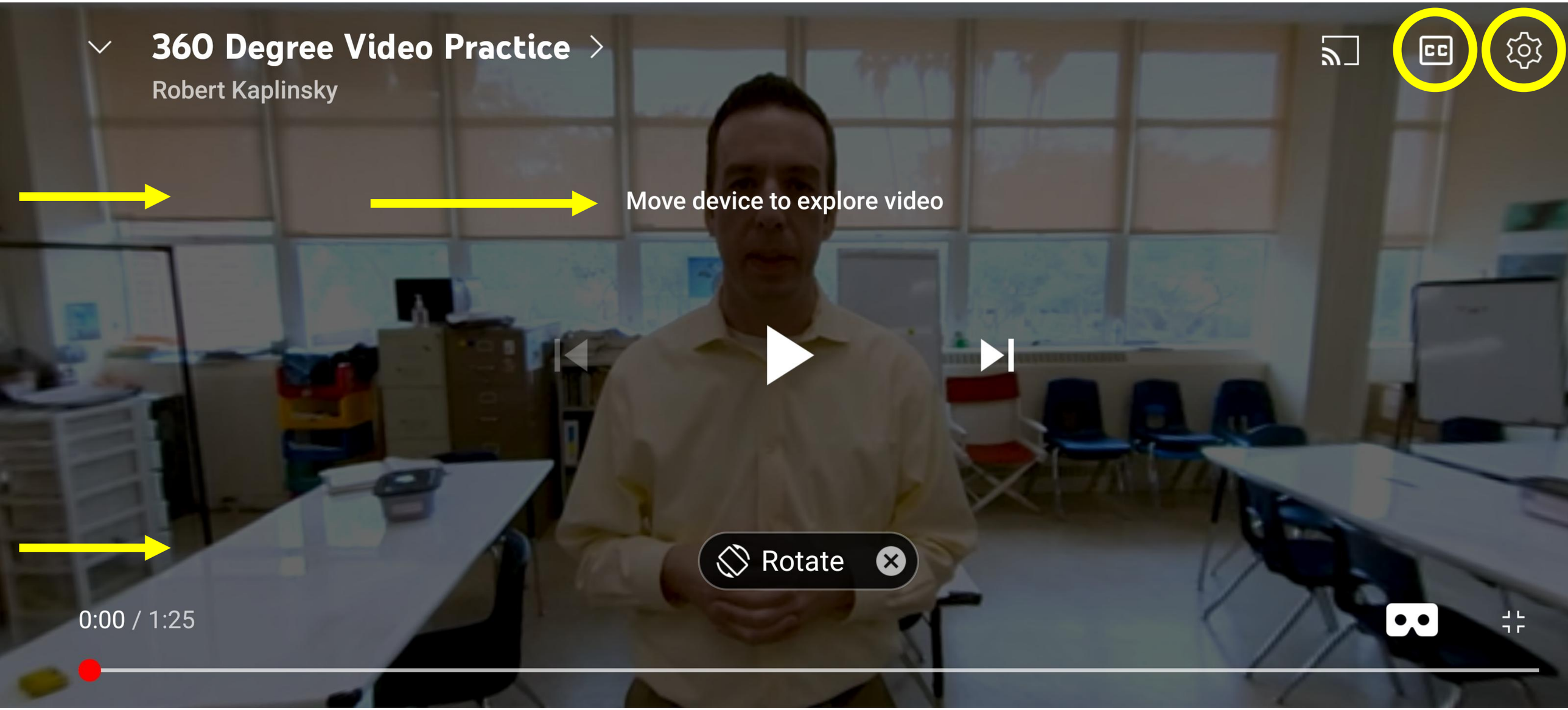
Concerns

- Math issues
  - Students struggle with two-digit multiplication
  - Students lack place value conceptual understanding
  - Students don't understand what a true equation is
- Open Middle issues
  - Students use a digit more than once.
  - Students use more than three digits in the product

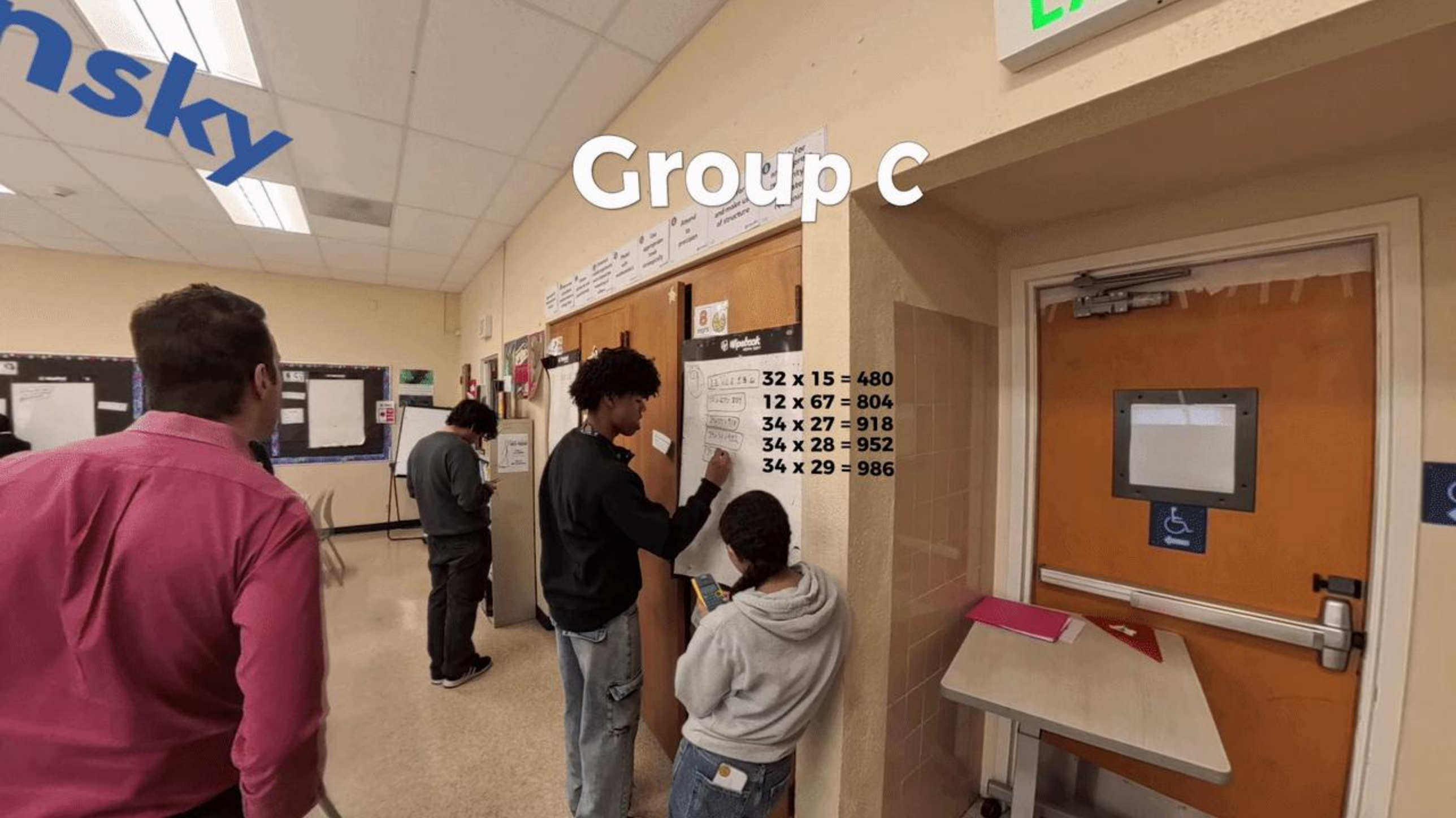
TOPICS

- [x] HOW SHOULD WE MEASURE A LESSON'S SUCCESS?
- [x] WHAT'S AN EXAMPLE WE CAN EXPLORE?
- [x] WHAT ARE OUR FACILITATING OPTIONS?
- [ ] WHAT DOES THIS LOOK LIKE IN ACTION?
- [ ] CONCLUSION

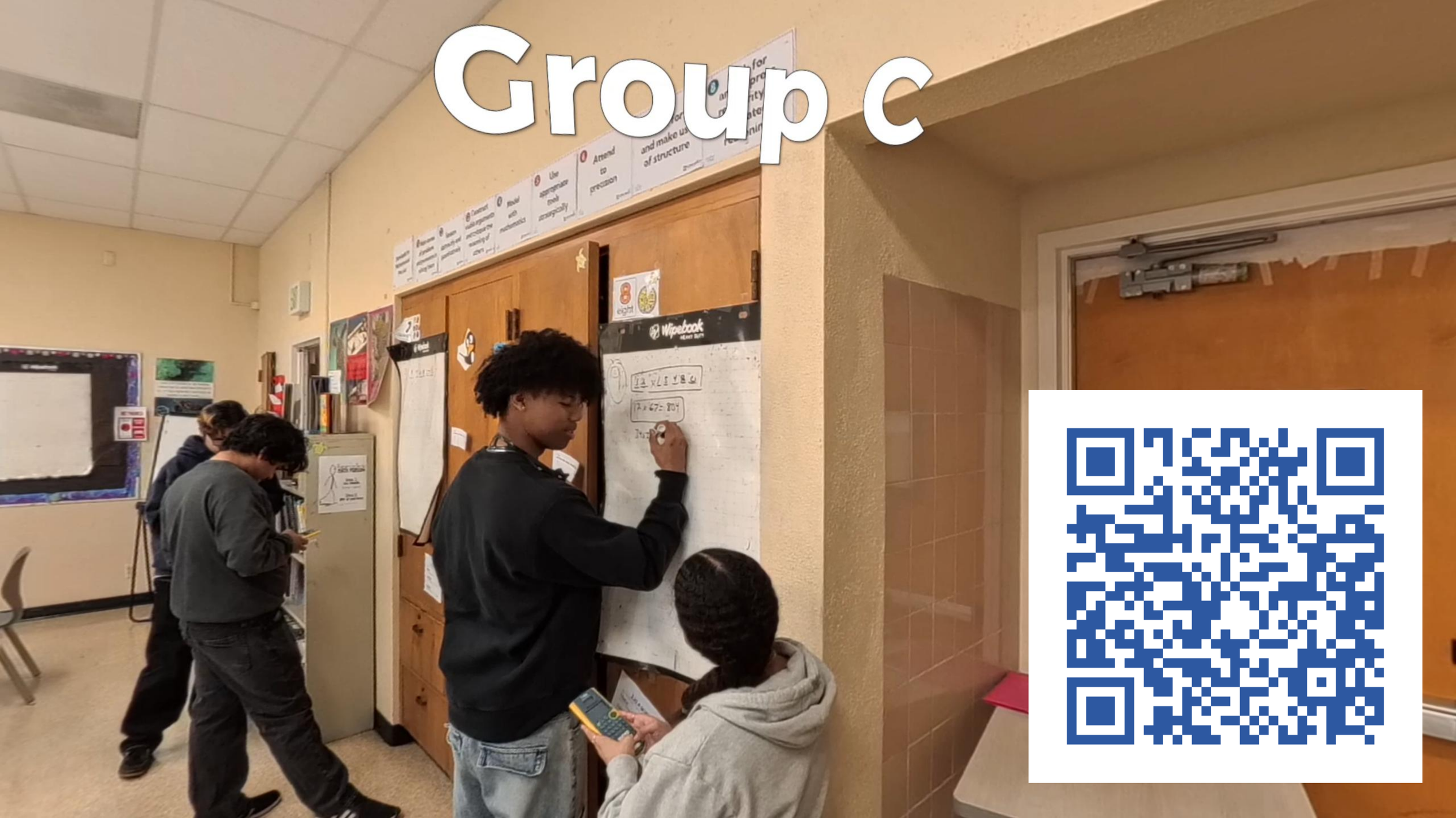



360 Degree Video Practice
Robert Kaplinsky
Move device to explore video
Rotate
0:00 / 1:25


participate
Determined
Focused
U2


Group C
32 x 15 = 480
12 x 67 = 804
34 x 27 = 918
34 x 28 = 952
34 x 29 = 986

Group C




Group B
Don't be afraid to reach out
To say Hi or to give a High 5!
Using the digits 0 to 9 at most one time each, place a digit in each box to create a true equation with the greatest possible product.
desmos
10 ten

TOPICS

- [x] HOW SHOULD WE MEASURE A LESSON'S SUCCESS?
- [x] WHAT'S AN EXAMPLE WE CAN EXPLORE?
- [x] WHAT ARE OUR FACILITATING OPTIONS?
- [x] WHAT DOES THIS LOOK LIKE IN ACTION?
- [ ] CONCLUSION

OUTCOMES HAVE ACTIONS

- Students get wrong answers
- Students get right answers
- Everyone else

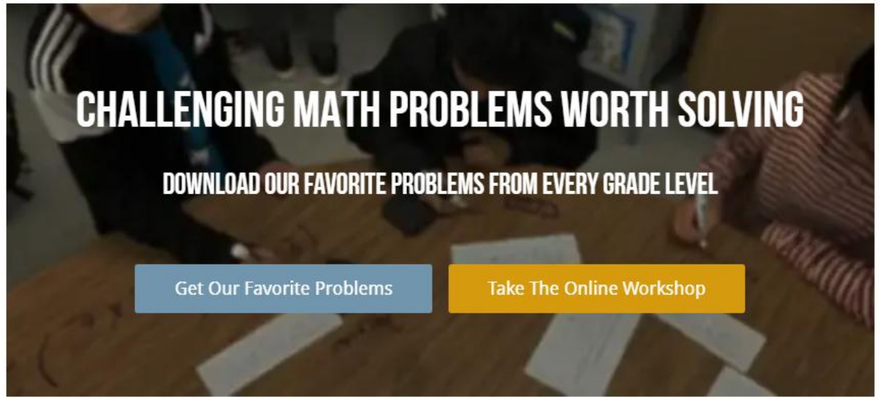


TOPICS

- [x] HOW SHOULD WE MEASURE A LESSON'S SUCCESS?
- [x] WHAT'S AN EXAMPLE WE CAN EXPLORE?
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- [x] WHAT DOES THIS LOOK LIKE IN ACTION?
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NUMBER TILES

Printable PDF with the digits 0 to 9
Printable PDF with the integers -9 to 9

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CLOSE TO 1000

Directions: Using the digits 1 to 9 exactly one time each, place a digit in each box to make the sum as close to 1000 as possible.



Hint

How do you know you can't get any closer to 1000? What should be true about the hundreds places of your three numbers? How do the tens places affect your answer?

Answer

Lots of answers will get you 999. One would be 247 + 563 + 189.
Is exactly 1000 even possible? Here's a Geogebra tool you can use to check your answer.

Source: John Ulbright and Robert Kaplinsky

Embed this problem | Print

Tags: 2.NBT.7 | 3.NBT.2 | DOK 3: STRATEGIC THINKING | JOHN ULBRIGHT | ROBERT KAPLINSKY

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33 COMMENTS

Talayla Banks — June 28, 2018 at 11:02 am

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Printable PDF with the integers -9 to 9

OPEN MIDDLE SLIDES

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About This Workshop

If you've heard of Open Middle problems and maybe used a few of them, but you're not satisfied with how things have gone and want consistently good results, then this mini workshop is for you. I want your students to love using Open Middle problems and have them be your favorite problems to use when getting observed.

We'll begin by discussing how Open Middle problems can help you and your students. Then we'll work through specific examples for grades K-1, 2-5, and 6-12. We'll use them to talk about how to prepare to use a problem as well as how to use them with students. Then we'll talk about where you can find more Open Middle problems to use and when and where you want to use them in your units. Finally, there's a bonus lesson on how you can use Open Middle problems at home with your own children.

If you have any questions, you can email me at robert@robertkaplinsky.com.

Mini

How To Use An Open Middle Problem

by Robert Kaplinsky

$49.00

(**$58.80** for 12 months of access)

How long would you like access?

Standard	Extended
4 Months	12 Months
$49.00	$58.80
Select	Select

1 Register Now

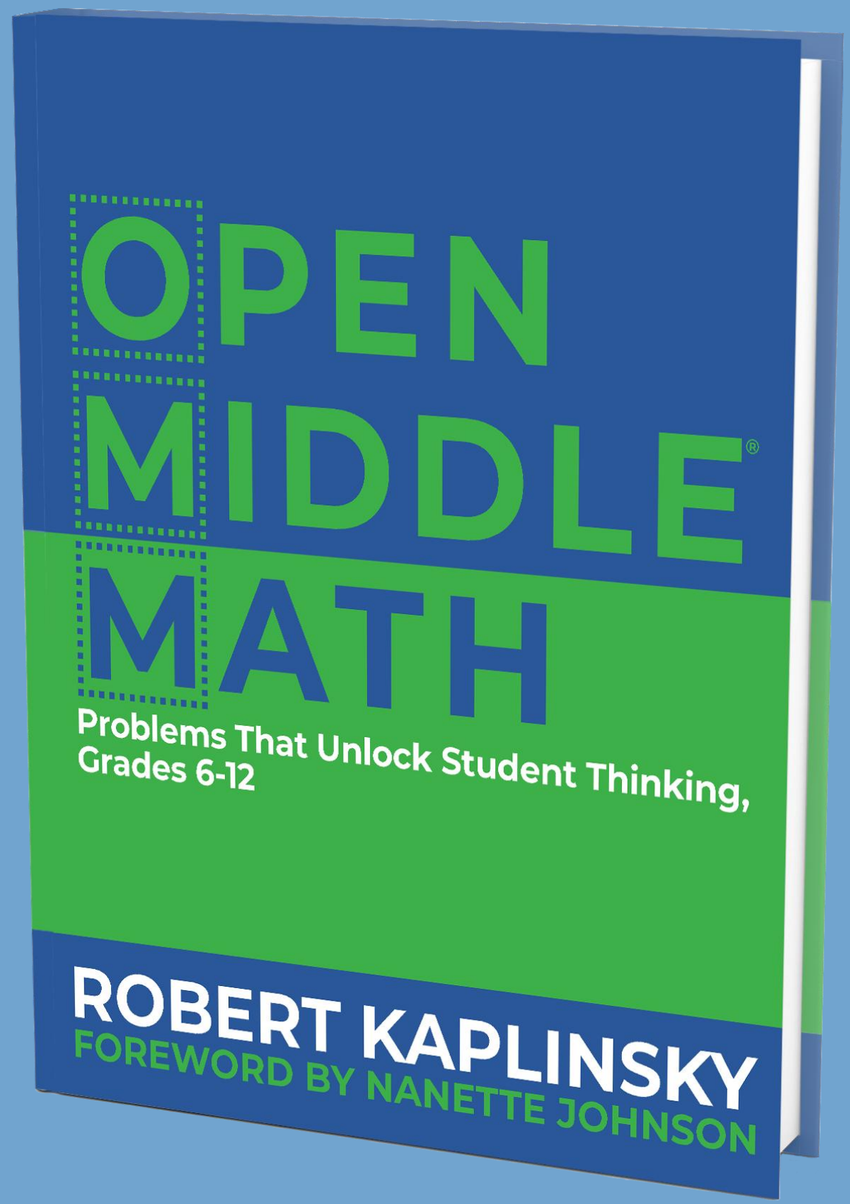
Subject: Mathematics

- Start Date: Immediate access
- Access for 4 months
- 3 Professional Development Hours
- Timing: Self-paced with no set meeting time
- 1 Graduate Level Professional Development Credit Available
- Topics Covered:
  - Open Middle
  - Depth of Knowledge
- One tree will be planted

Share Registration Link

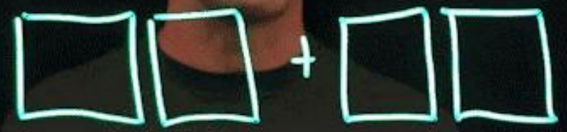
Download Fact Sheet

link.robertkaplinsky.com/openmiddle



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Using the digits 1 to 9, at most one time each, place a digit in each box to make the largest sum.



Using the digits 0 to 9 at most one time each, place a digit in each box to make two different three-digit numbers that round to 500.



Using the digits 1 to 9, at most one time each, place a digit in each box to make the greatest product.



WHAT DO YOU DO WHEN A RICH MATH PROBLEM GOES SIDEWAYS?

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robertkaplinsky.com/sideways

@robertkaplinsky

