2014
NCTM
National Council
Teachers of Mathematics
Annual Meeting

Connect Multiplication and Division Using Area Models

Presented By:

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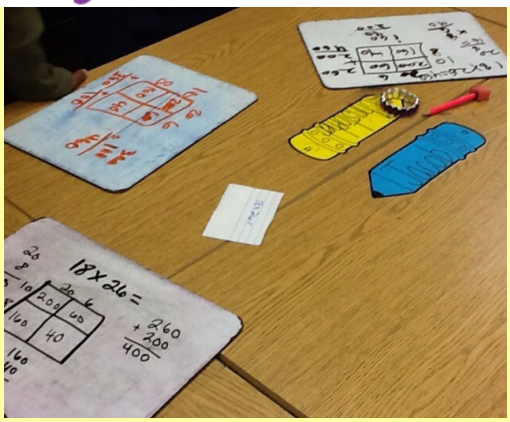
Melinda Villalovos District Math Coach

Apr 1-11:27 AM

Take a look!



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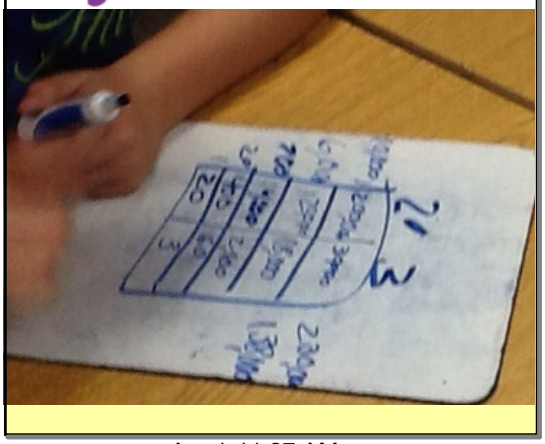
Take a look!



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Background Knowledge

- Understand what an array is (rows, columns, ten-frame, conserving 5 (subitizing), repeated addition, etc...)
- Have a conceptual understanding of multiplication and division given contexts
- Basic understanding of concrete, pictorial and symbolic representations of multiplication and division

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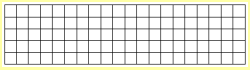
PROBLEM #1

Your school needs to determine how many seats are available for this year's 8th grade graduation. An array of the seating is provided and each unit square represents a seat.



- Take out your rectangle made of grid paper
- 1.Fold your array into smaller rectangles to help you quickly count the total seats.

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SHARE OUT

With a neighbor...

At your table...

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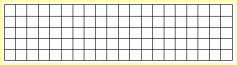
PROBLEM #1

Your school needs to determine how many seats are available for this year's 8th grade graduation. An array of the seating is provided and each unit square represents a seat.



- *2. Using your rectangles, create an equation representing total area of the original rectangle.*

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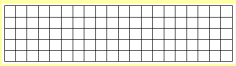
PROBLEM #1

Your school needs to determine how many seats are available for this year's 8th grade graduation. An array of the seating is provided and each unit square represents a seat.



- *3. Write a multiplication sentence using the* ***Area Formula*** *that represents the* ***WHOLE*** *rectangle to show the total seats.*

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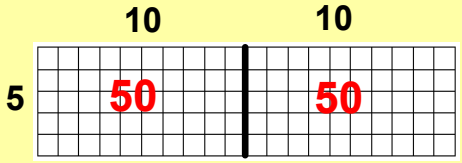
PROBLEM #1

SAMPLE ANSWER



(5 x 10) + (5 x 10) = 100

5 x 20 = 100

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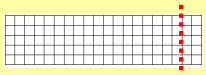
PROBLEM #2

If 2 columns of seats were removed from your array, how would that change the way you find the total seats?



- *1. Fold back 2 columns at one end of your rectangle.*

  Fold your new array into smaller rectangles to help you quickly count the total seats.

- *2. Using your rectangles, create an equation representing total area of the original rectangle.*

- *3. Write a multiplication sentence using the Area Formula that represents the WHOLE rectangle to show the total seats.*

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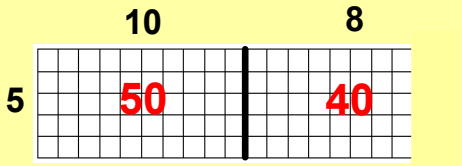
PROBLEM #2

SAMPLE ANSWER



(5 x 10) + (5 x 8) = 90

5 x 18 = 100

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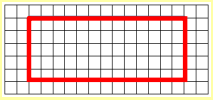
PROBLEM #3

Look at Problem #3 in your packet. The outlined rectangle, again, represents the total number of seats at a graduation.



1. Race against your partner to find the fastest way to count the total seats.
(You only know your multiplication facts to 10.)

2. Using your rectangles, create an equation representing total area of the original rectangle.

*3. Write a multiplication sentence using the **Area Formula** that represents the **WHOLE** rectangle to show the total seats.*

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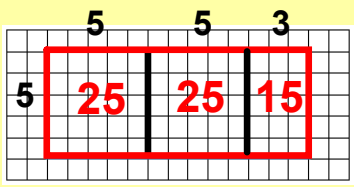
PROBLEM #3

SAMPLE ANSWER



(5 x 5) + (5 x 5) + (5 x 3)= 65

5 x 13 = 65

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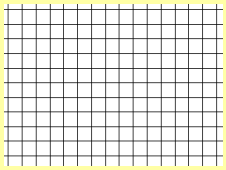
PROBLEM #4

Look at Problem #4 in your packet.

1. Find the product using an array.

18 x 26

18 x 26



2. Using your rectangles, create an equation representing total area of the original rectangle.

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PROBLEM #4

18 x 26

	10	10	6
10	100	100	60
8	80	80	48

(10x10)+(10x10)+(10x6)+
(8x10)+(8x10)+(8x6)= 468

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PROBLEM #4

18 x 26

	20	6
10	200	60
8	160	48

(10x20)+(10x6)+(8x20)+(8x6)= 468

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PROBLEM #4

3. *What if we had no graphpaper?*

How can we find the product using an OPEN AREA MODEL?

18 x 26

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PROBLEM #4

18 x 26

	20	6
10	200	60
8	160	48

(10x20)+(10x6)+(8x20)+(8x6)= 468

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PROBLEM #4

4. How does this connect to a standard algorithm? Try it!

18 x 26

	20	6
10	200	60
8	160	48

→

```
  26
x 18
  48
 160
  60
+200
 468
```

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PROBLEM #4

Moving towards a standard algorithm...

18 x 26

	20	6
10	200	60
8	160	48

→

```
  26
x 18
  48
 160
  60
+200
 468
```

→

```
  26
x 18
 208
+260
 468
```

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DIVISION

PROBLEM #5

- You have to set up chairs in your cafeteria for a band concert. You have a total of 54 chairs and need 6 rows. How many chairs will be in each row? **(facts to 5)**

1. Draw an array to show the number of chairs in each row.

Draw lines on your array to show your thinking as you build your array.

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With a neighbor...

At your table...

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PROBLEM #5

- *2. Write a division sentence to show how you found the number of chairs in each row.*

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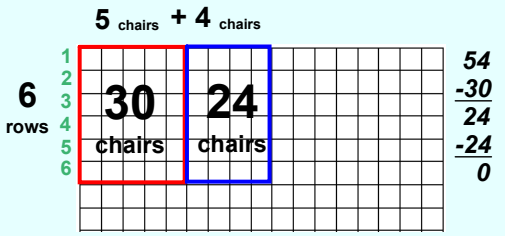
PROBLEM #5

SAMPLE ANSWER

54 chairs ÷ 6 rows = 9 chairs per row

54 ÷ 6 = 9



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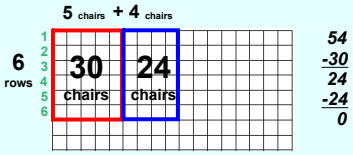
PROBLEM #5

3. Write a multiplication sentence to validate your thinking?



54 chairs ÷ 6 rows = 9 chairs per row

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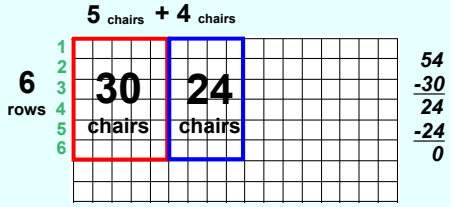
PROBLEM #5

6 rows x 9 chairs = 54 total chairs

(6x5)+(6x4) = 54



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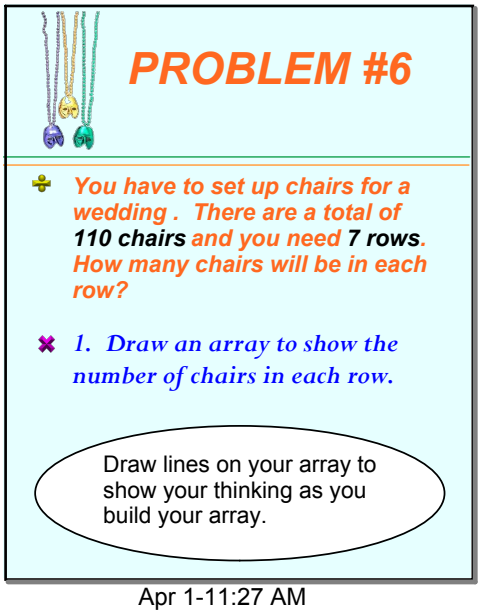

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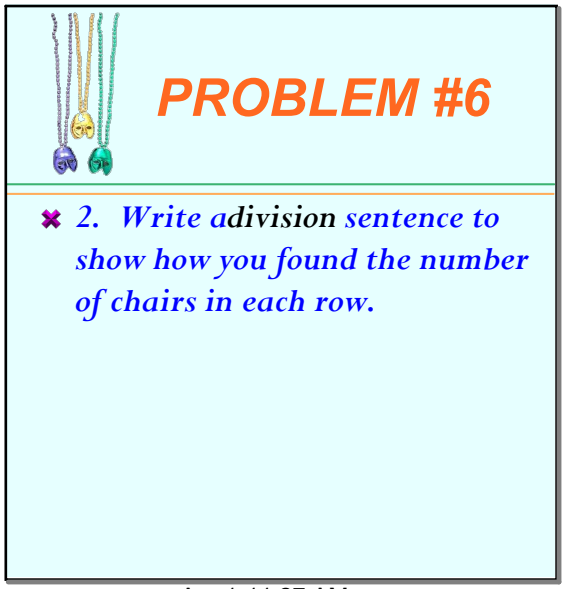

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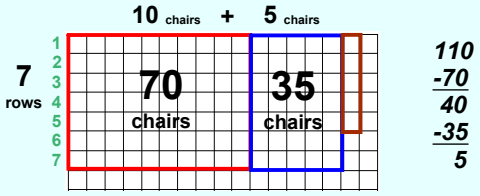
PROBLEM #6

SAMPLE ANSWER

110 chairs ÷ 7 rows = 15 chairs per row and 5 left over

110÷7 = 15 r5



110
-70
40
-35
5

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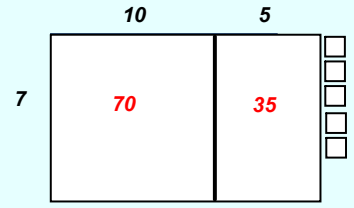
PROBLEM #6

SAMPLE ANSWER

110 chairs ÷ 7 rows = 15 chairs per row and 5 left over

110÷7 = 15 r5



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-70
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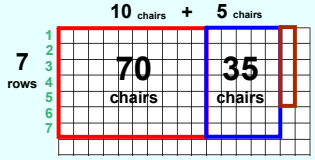
PROBLEM #6

3. Write a multiplication sentence to validate your thinking?



110
-70
40
-35
5

110 chairs ÷ 7 rows = 15 chairs per row and 5 left over

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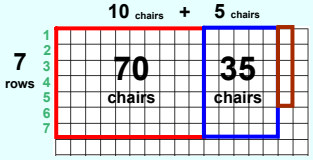
PROBLEM #6

(7 x 10) + (7 x 5) + 5 = 110

(7 x 15) + 5 = 110



110
-70
40
-35
5

110 chairs ÷ 7 rows = 15 chairs per row and 5 left over

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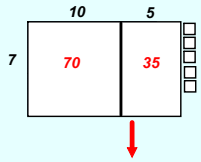
PROBLEM #6

4. How does this connect to a standard algorithm? Try it!

110 ÷ 7 =



$7\overline{)110}$ =

10 + 5

$7\overline{)70 + 35 + 5}$

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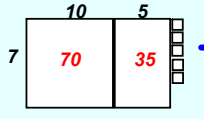
PROBLEM #6

Moving towards a standard algorithm...

110 ÷ 7 =



$7\overline{)110}$

-70 7x10

40

-35 7x5

5

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PROBLEM #6

Moving towards a standard algorithm...

$110 \div 7 =$

$$\begin{array}{r} 7\overline{)110} \\ -70 \\ \hline 40 \\ -35 \\ \hline 5 \end{array} \quad 7\times10 \quad 7\times5 \qquad \rightarrow \qquad \begin{array}{r} 15 \\ 7\overline{)110} \\ -7 \\ \hline 40 \\ -35 \\ \hline 5 \end{array}$$

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PROBLEM #7

- *1. Draw an array AND open area model to find the quotient.*

$225 \div 14$

Draw lines on your array to show your thinking as you build your array.

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SHARE OUT

With a neighbor...

At your table...

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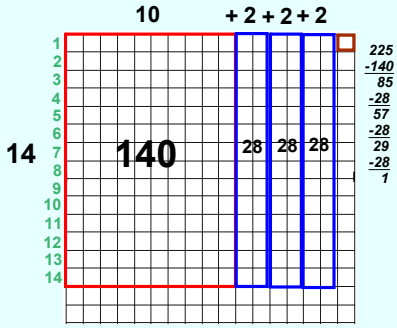
PROBLEM #7

SAMPLE ANSWER

225 ÷ 14 = 16 r1



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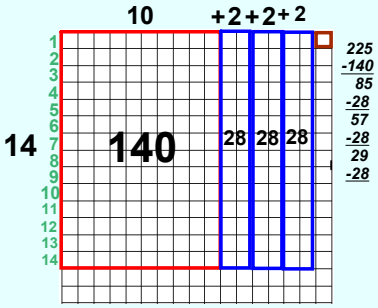
PROBLEM #7

2. Write a multiplication sentence to validate your thinking?



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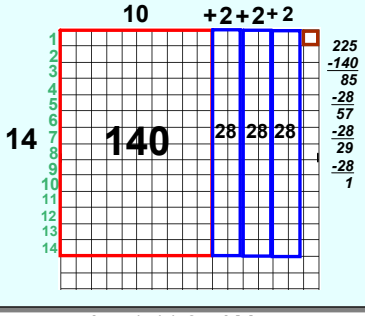
PROBLEM #7

(14x10) + 14(2) + 14(2) + 14(2) + 1 = 225

(14 x 16) + 1 = 225



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PROBLEM #7

3. How does this connect to a standard algorithm? Try it!

$225 \div 14 =$

	10	2	2	2	
14	140	28	28	28	□

$14\overline{)225} =$

$10 + 2 + 2 + 2$

$14\overline{)140+28+28+28+1}$

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PROBLEM #7

Moving towards a standard algorithm...

$225 \div 14 =$

$14\overline{)225}$

-140 14x10

85

$-\ 28$ 14x2

57

$-\ 28$ 14x2

29

$-\ 28$ 14x2

1

16

$14\overline{)225}$

-14

85

$-\ 84$

1

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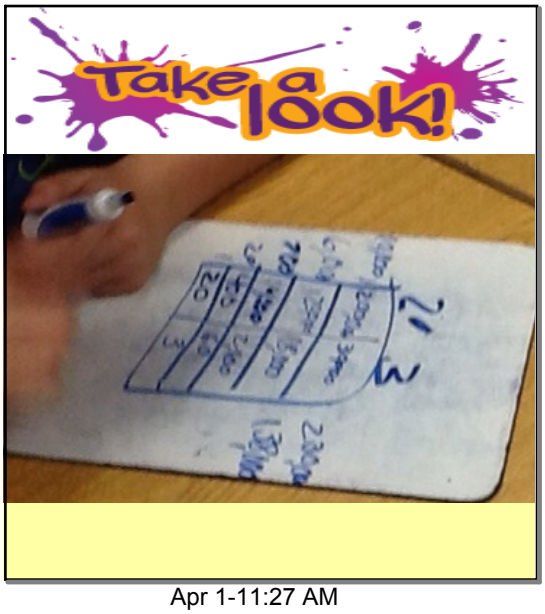

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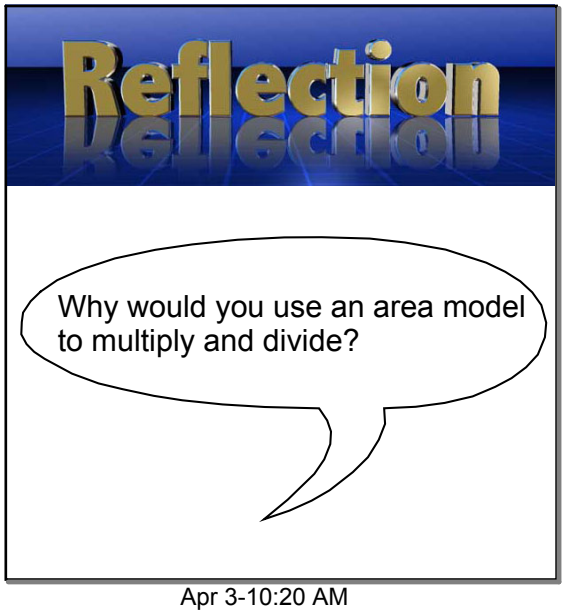

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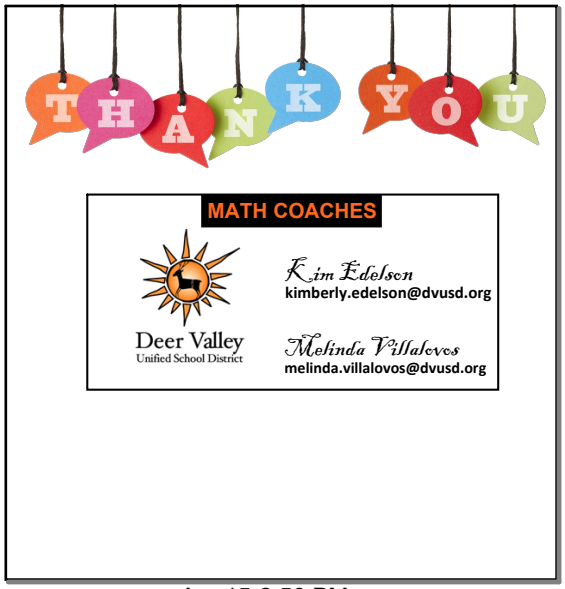

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