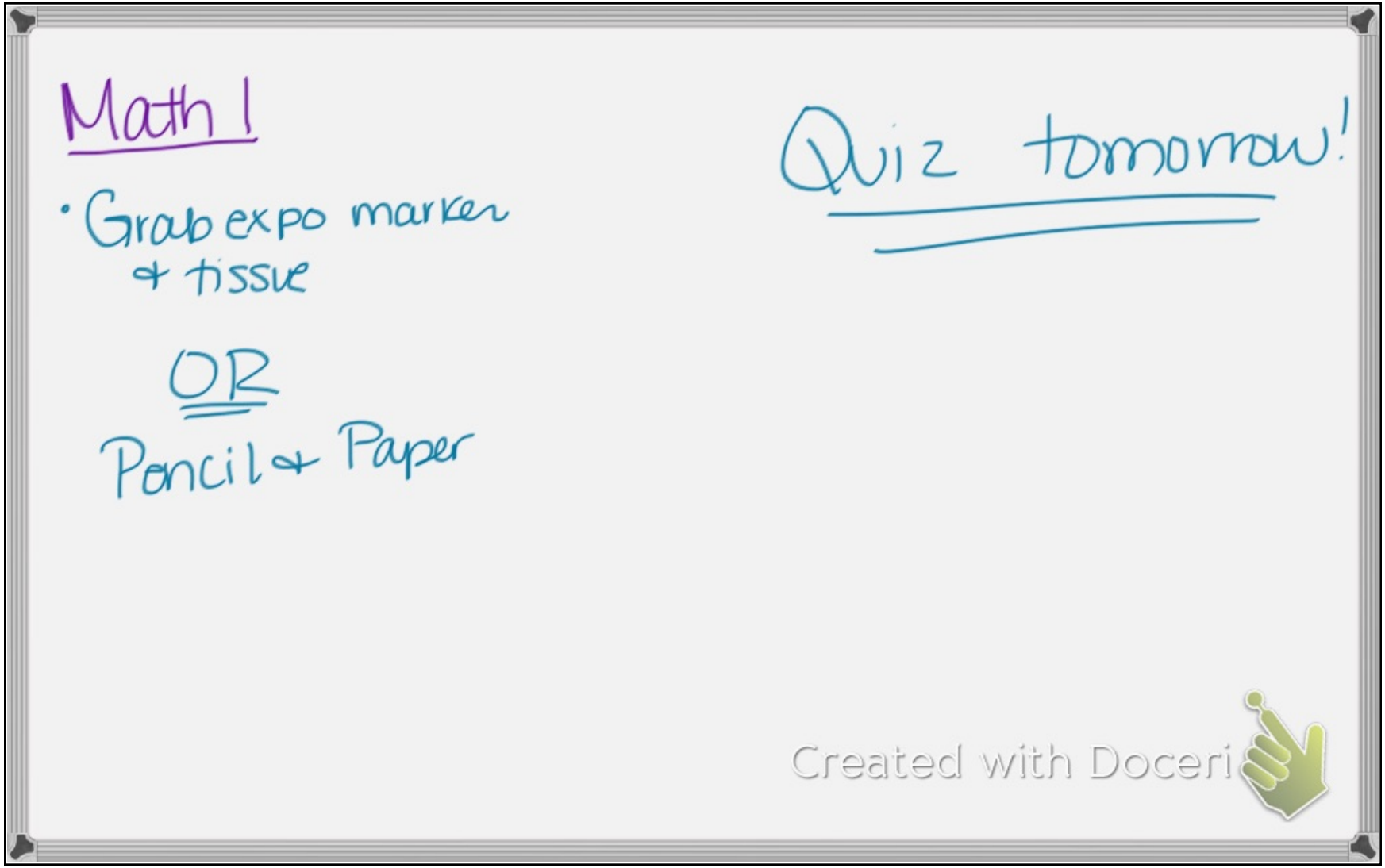
Math 1
• Grab expo marker & tissue
OR
Pencil & Paper
Quiz tomorrow!
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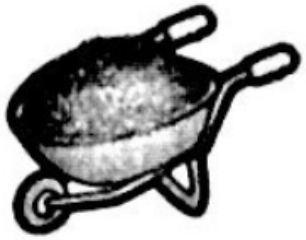
[redacted] expressions were represented in two forms

- Factored $(x+m)(x+n)$ Dimensions (L & W)
- Expanded x^2+bx+c Areas (Standard)

In this investigation, you will explore how to use the area model when the quadratic expressions have a coefficient of x^2 that is not 1. You will be able to rewrite these expressions in factored or expanded form.

Consider the situation where a housing developer is preparing to order mulch for landscaping. She must know the area of each lot to determine how much to order.



1. There are three lots that have exactly the same width and length. The developer finds that the total area of all three lots together can be represented by $3x^2+21x+30$ where x is the length of the original square lot.

   a. Write an expression that represents the area of one of the three lots? Explain your reasoning.

   $x^2+7x+10$ $x^2+7x+10$ $x^2+7x+10$

   b. Use an area model to rewrite the expression as the product of the length and width of each of these lots.

	x	$+5$
x	x^2	$5x$
$+2$	$2x$	10

$II+III=7$

$I \cdot IV=10$

1 10

+2 +5

$(x+5)(x+2)$

L W

   c. The total area of the three lots can be written with equivalent expressions. Write three different expressions that represent the total area of all three lots. Identify which one is in expanded form and which one is in *completely* factored form.

$3x^2+21x+30=3(x^2+7x+10)=3(x+5)(x+2)$

2 In the previous problem, all three coefficients were multiples of 3 making it possible to rewrite the expression to represent the area of each lot and the dimensions of each lot. Use similar reasoning to work with each of the following expressions and rewrite them into a completely factored form.

a $2x^2 + 24x + 70$

$2(x^2 + 12x + 35)$

$2(x+5)(x+7)$

b $5x^2 + 10x - 40$

$5(x^2 + 2x - 8)$

$5(x-2)(x+4)$

c $10x^2 + 40x + 30$

d $3x^2 + 12x + 36$

e $4x^2 + 60x + 216$

f $5x^2 + 15x - 10$

g $8x^2 - 80x + 168$

h $3x^2 - 3$

a. $x^2 + 12x + 35$

	x	+5
x	x^2	5x
+7	7x	+35

II + III = 12 (+5 +7)

I · IV = 35 (1 35)

b $x^2 + 2x - 8$

	x	-2
x	x^2	-2x
+4	+4x	-8

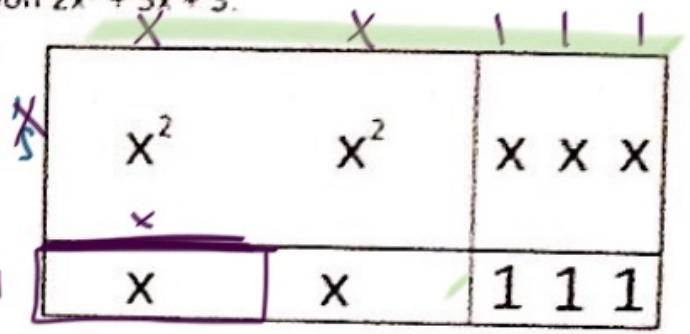
II + III = 2 (1 8, -2 +4)

I · IV = -8

3. Another lot has a total area represented by the expression $2x^2 + 5x + 3$.

   a. How does the area model to the right represent the expression for the total area of the lot?

two x^2's, 5 x's & three 1's

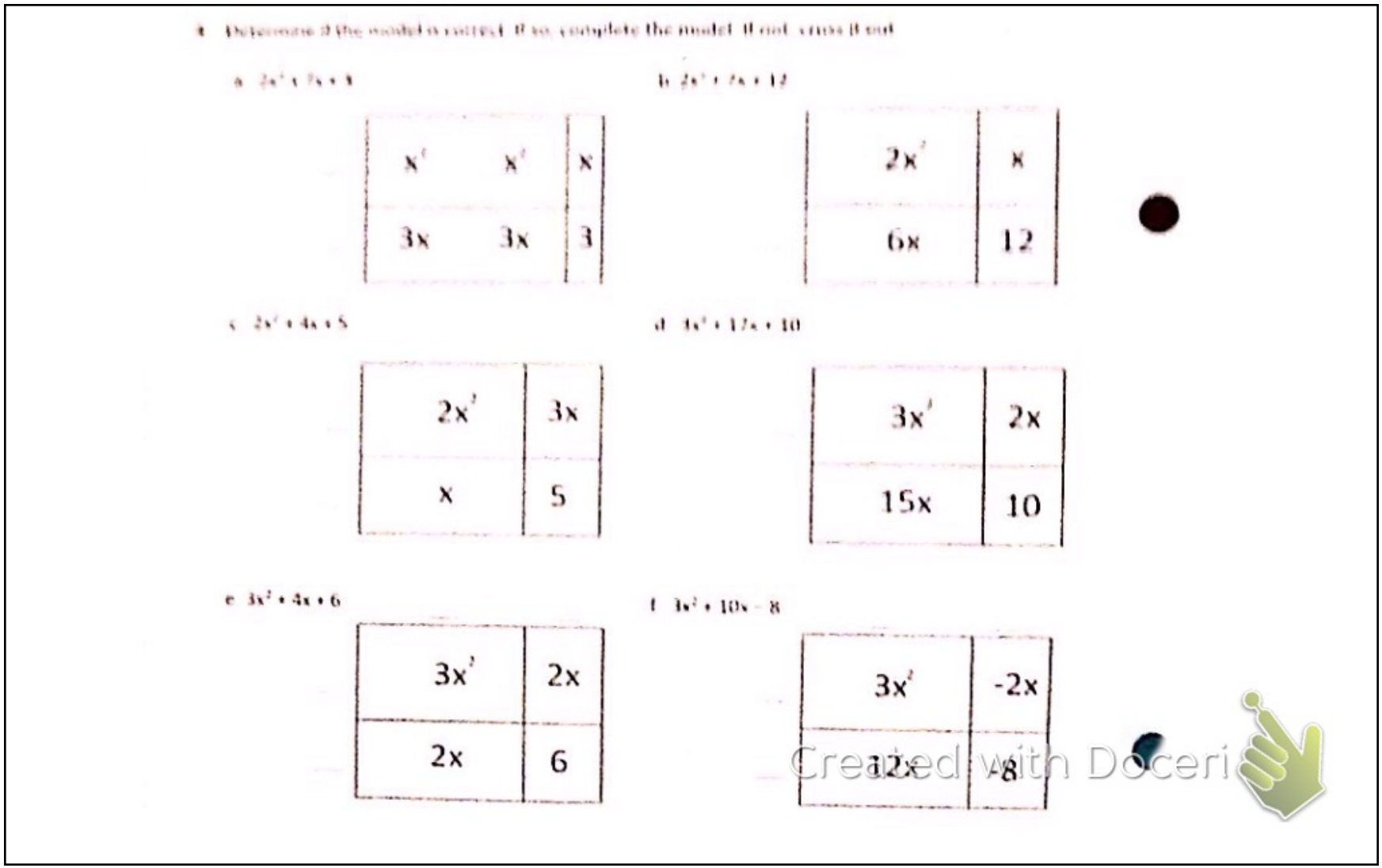


   b. How is this different than the expressions in problems 1 and 2?

there is no gcf to factor out

   c. Write the factored form that represents the product of the length and width of the lot.

$(2x+3)(x+1)$



5. Use the area model to factor each of the following.

a. $3x^2 + 4x + 1$

b. $2x^2 + 5x + 2$

c. $7x^2 + 20x - 3$
$(7x-1)(x+3)$

d. $5x^2 - 14x - 3$
$(5x+1)(x-3)$

e. $4x^2 + 13x - 12$
$(4x-3)(x+4)$

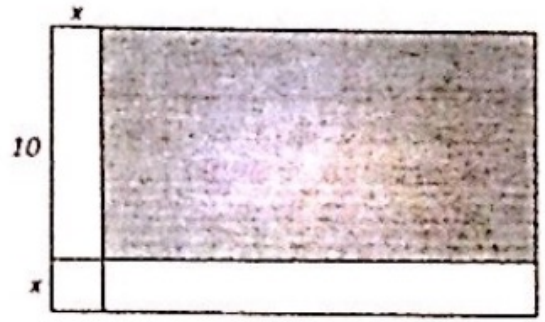
f. $2x^2 + 9x - 35$
$(2x-5)(x+7)$

The process of rewriting the expanded expression into a factored expression is called *factoring*. The area model uses the fact that a rectangle's area is the product of the length and width (factored form) and the sum of the individual areas (expanded form). It is a visual representation of this algebraic procedure and can be used for any factorable expression. *Yes, there are expressions that cannot be factored.*

6. Use the area model to rewrite each expression in factored form.
   a. $4x^2 - 32x + 60$
   b. $2x^2 + 13x + 15$
   c. $x^2 + 10x + 25$
   d. $x^2 - 25$
   e. $5x^2 - 30x + 45$

Check Your Understanding

a. The area of the rectangle shown in the figure is $3x^2 + 38x + 80$. What is the area of the shaded region?



b. Factor each of the following expressions

i. $6x^2 + 6x - 12$

ii. $x^2 - 49$

iii. $2x^2 - 5x - 3$

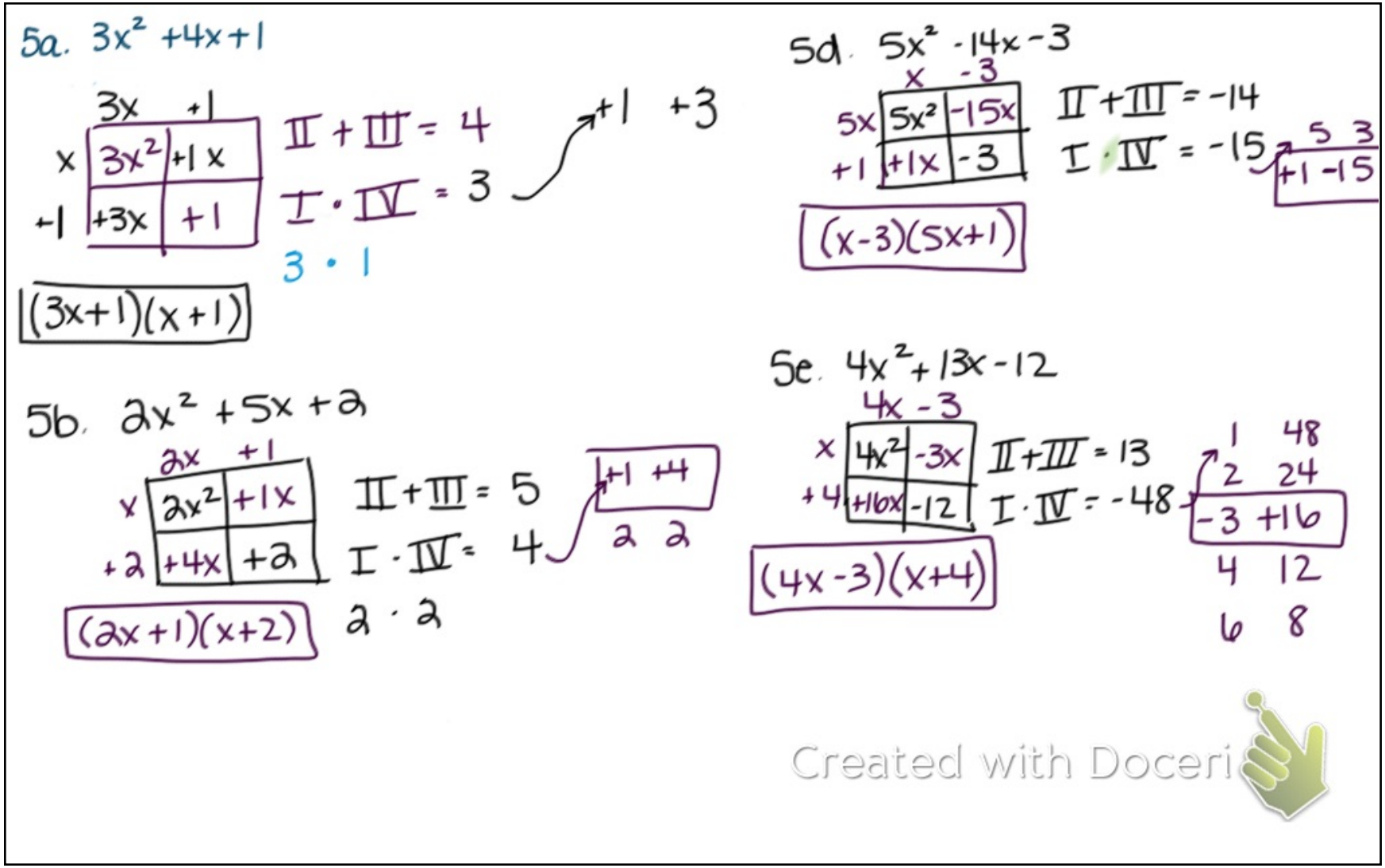
iv. $x^2 + 14x + 49$

v. $5x^2 - 5x - 30$

vi. $3x^2 - 7x + 2$

vii. $x^2 - 20x + 100$

viii. $4x^2 - 81$


5a. $3x^2+4x+1$
3x +1
x $3x^2$ +1x
+1 +3x +1
II + III = 4
I · IV = 3
+1 +3
3 · 1
(3x+1)(x+1)
5b. $2x^2+5x+2$
2x +1
x $2x^2$ +1x
+2 +4x +2
II + III = 5
I · IV = 4
+1 +4
2 2
2 · 2
(2x+1)(x+2)
5d. $5x^2-14x-3$
x -3
5x $5x^2$ -15x
+1 +1x -3
II + III = -14
I · IV = -15
5 3
+1 -15
(x-3)(5x+1)
5e. $4x^2+13x-12$
4x -3
x $4x^2$ -3x
+4 +16x -12
II + III = 13
I · IV = -48
1 48
2 24
-3 +16
4 12
6 8
(4x-3)(x+4)
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6a. $4x^2 - 32x + 60$

$4(x^2 - 8x + 15)$

$\boxed{4(x-3)(x-5)}$

6b. $3x^2 + 13x + 15$

$\boxed{(3x+3)(x+5)}$

c. $(x+5)(x+5)$

d. $x^2 - 25$

	x	$+5$
x	x^2	$+5x$
-5	$-5x$	-25

II + III = 0

I · IV = −25

+5 −5

$\boxed{(x-5)(x+5)}$

e. $5(x^2 - 6x + 9)$

$\boxed{5(x-3)(x-3)}$

6a. $4(x^2 - 8x + 15)$

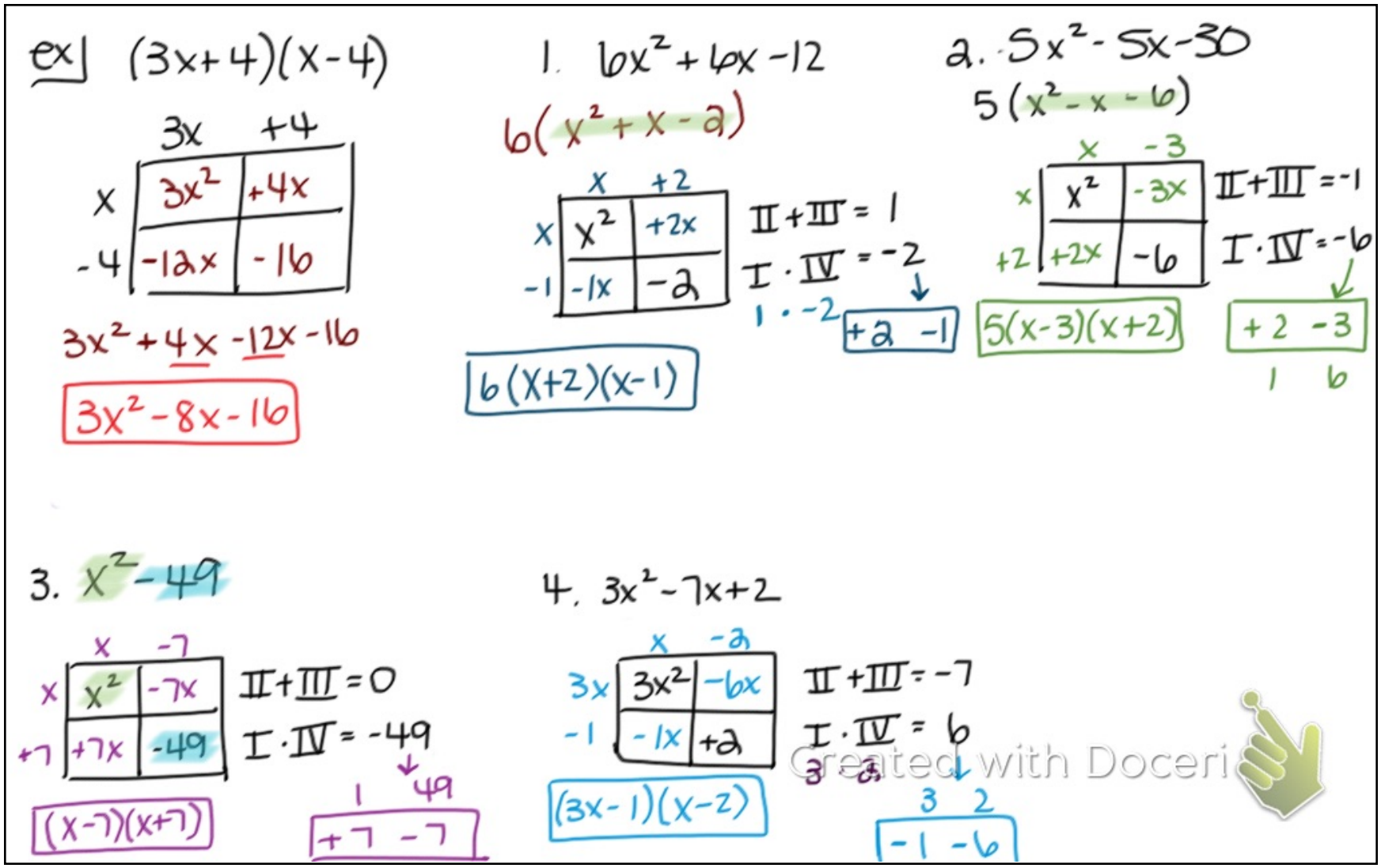
	x	-5
x	x^2	$-5x$
-3	$-3x$	15

II + III = −8

I · IV = 15

−5 −3

1 15


ex $(3x+4)(x-4)$
$3x^2+4x-12x-16$
$3x^2-8x-16$
1. $6x^2+6x-12$
$6(x^2+x-2)$
II+III = 1
I·IV = -2
1 · -2
+2 -1
$6(x+2)(x-1)$
2. $5x^2-5x-30$
$5(x^2-x-6)$
II+III = -1
I·IV = -6
+2 -3
1 6
$5(x-3)(x+2)$
3. x^2-49
II+III = 0
I·IV = -49
1 49
+7 -7
$(x-7)(x+7)$
4. $3x^2-7x+2$
II+III = -7
I·IV = 6
3 2
-1 -6
$(3x-1)(x-2)$
Created with Doceri

5. $2x^2-5x-3$

	$2x$	$+1$
x	$2x^2$	$+1x$
-3	$-6x$	-3

II + III = -5

I · IV = -6

$+1 \cdot -6 = -6$ ✓

$-2 \cdot -3 = 6$ X

$(2x+1)(x-3)$

6. $x^2-20x+100$

	x	-10
x	x^2	$-10x$
-10	$-10x$	100

II + III = -20

I · IV = 100

1	100
2	50
4	25
5	20
-10	-10

$(x-10)(x-10)$

$(x-10)^2$

7. $x^2+14x+49$

	x	$+7$
x	x^2	$+7x$
$+7$	$+7x$	49

II + III = 14

I · IV = 49

$+7 \quad +7$

1 49

$(x+7)(x+7)=(x+7)^2$

8. $4x^2-81$

9. ~~$3x^2+24x+21$~~

$3(x^2+8x+7)$

	x	$+7$
x	x^2	$+7x$
$+1$	$+1x$	$+7$

II + III = 8

I · IV = 7

$3(x+7)(x+1)$ $+1$ $+7$

10. $2m(4m+4)$

	$2m$
$4m$	$8m^2$
$+4$	$8m$

$8m^2+8m$