



Developing the Essential Strategies for Computation

PROFESSIONAL DEVELOPMENT

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James Burnett, M.Ed.

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EDUCATION



Why focus on mental computation?

- It is the form of calculation used by numerate people.
- It makes sense.
- It develops number sense.
- It promotes thinking and reasoning skills.
- It provides an insight into student's thinking and understanding
- When students use the written algorithm they often get the wrong answers.

This or That Again?

Round	Player One	Player Two	Player Three
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Materials: 3 standard dice

Computational Fluency

develops from:

- Number sense activities
- Connections built through algebraic experiences
- Visual aids and models
- Appropriate games

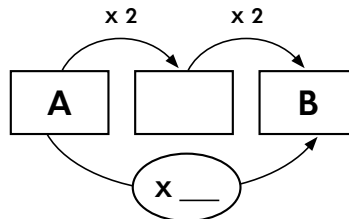
Good number sense activities possess one or more of the following characteristics:

- provide open input
- are embedded in context
- encourage visual thinking
- use multiple models for number
 - counting
 - relative position
 - quantity
 - place value
- establish connections
- encourage students' language
- promote personal thinking
- support mental computation
- foster a search for patterns
- involve logical reasoning
- promote creative thought
- involve estimation

Provide open input

13

Look at this arrow chart.



1. What number should appear in Box A, if
 - a. 18 is placed in Box B?
 - b. 42 is placed in Box B?
 - c. 26 is placed in Box B?
 - d. 34 is placed in Box B?
2. What number should appear in the oval?

Computation and Number Sense

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8

Copy and complete each of these. Write a number **greater than one** in each box

- a. x 25 x 6 = ____
- b. 5 x 12 x = ____
- c. 7 x x 4 = ____
- d. x 24 x 2 = ____

Computation and Number Sense

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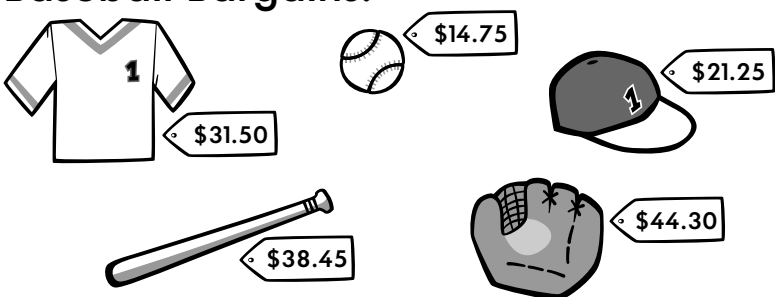
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Are embedded in context

20

Baseball Bargains!



How much change would you receive from **\$50** if you bought

- the shirt?
- the glove?
- the bat?
- the ball and cap?

Computation and Number Sense © ORIGO Publications Green Tank


3

Rewrite the story below using each of these numbers only once. Your story must make sense.

1.95 7.80 4

10 2.20

Gemma bought ____ ice cream cones. She paid \$ ____ each. The total cost was \$ _____. She received \$ ____ change from \$ _____.



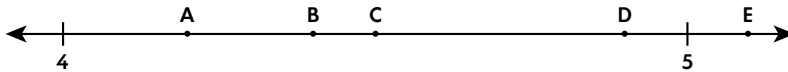
NUMBER JUGGLERS

Computation and Number Sense © ORIGO Publications Red Tank

Use multiple models for number – relative position

17

Look at this number line.



What numbers could be **located** at points A, B, C, D, and E?

Computation and Number Sense

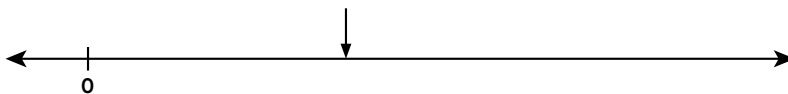
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1

Trace this number line onto another sheet of paper.



If the arrow is pointing to **50**, mark where you think these numbers are **located**.

- a. 65
- b. 100
- c. 10
- d. 45
- e. 110

Computation and Number Sense

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Use multiple models for number – place value

18

Look at these digits.

2 7 3 5

Use each digit only once. Write

- the **greatest** (biggest) odd number possible.
- the **least** (smallest) even number possible.
- two numbers that are **close to 5,300**.
- two numbers that have a **difference of 9**.

Computation and Number Sense

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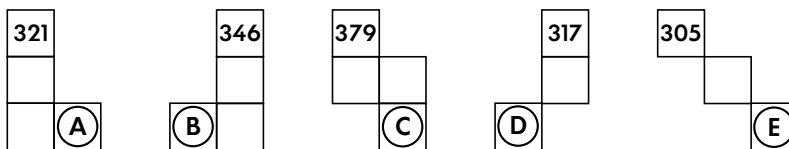


2

Here is a **chunk** of a hundred chart.

301	302	303	304	305	306	307	308	309	310
311	312	313	314	315	316	317	318	319	320

Here are some **pieces** of the same chart.



Write the numbers that belong at A, B, C, D, and E.

Computation and Number Sense

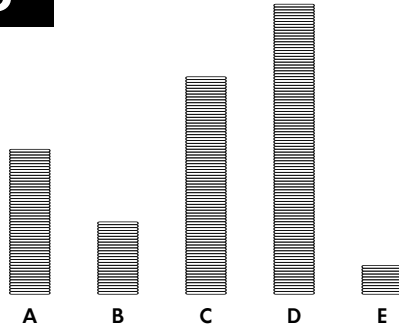
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Involve estimation

13



Stack A has 50 coins.

- Estimate the number of coins in each stack.
- If each coin is **10 cents**, what is the value of each stack?
- If each coin is **5 cents**, what is the value of each stack?
- How did you figure out the answers to **Question C**?

Computation and Number Sense

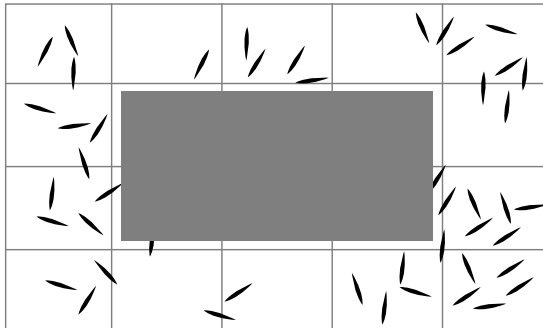
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1

These seeds are spread fairly evenly over a grid.
Part of the grid has been covered.



- Estimate the **total number** of seeds on the grid.
- Write how you made your estimate.

Computation and Number Sense

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Take or Tally

Player 1

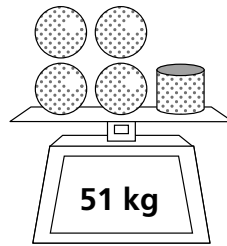
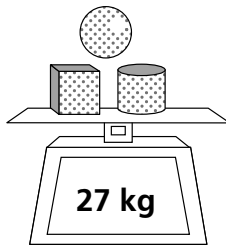
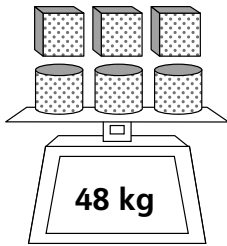
Player 2

$13 - \underline{\quad} = \underline{\quad}$	$13 - \underline{\quad} = \underline{\quad}$
$12 - \underline{\quad} = \underline{\quad}$	$12 - \underline{\quad} = \underline{\quad}$
$11 - \underline{\quad} = \underline{\quad}$	$11 - \underline{\quad} = \underline{\quad}$
$10 - \underline{\quad} = \underline{\quad}$	$10 - \underline{\quad} = \underline{\quad}$
$9 - \underline{\quad} = \underline{\quad}$	$9 - \underline{\quad} = \underline{\quad}$
$8 - \underline{\quad} = \underline{\quad}$	$8 - \underline{\quad} = \underline{\quad}$
Tally	Tally




Cube A: 1, 2, 3, 1, 2, 3

Cube B: 7, 8, 9, 10, 11, 12

5



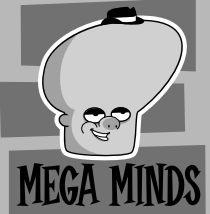
Same shapes are the same number of kilograms.

- a.  = ____ kg
- b.  = ____ kg
- c.  = ____ kg

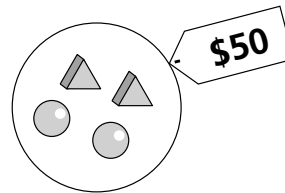
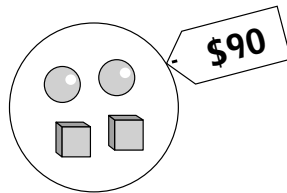
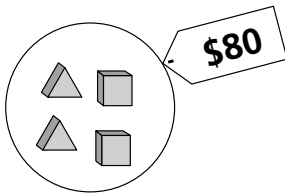
Thinking Mathematically and Problem Solving

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17



Same shapes are the same price.

- a.  \$ _____
- b.  \$ _____
- c.  \$ _____

Thinking Mathematically and Problem Solving

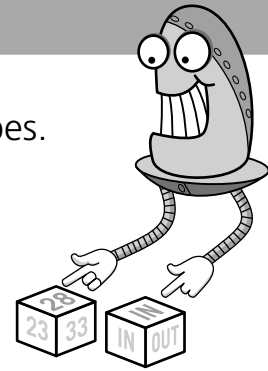
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Blue Tank



Write these numbers and words on the faces of two cubes.

Cube 1 –	23	28	33	37	44	56
Cube 2 –	IN	IN	IN	OUT	OUT	OUT



If you rolled this, you would write 28 in the top row.

Roll both cubes. Write the number from the roll of Cube 1 in the row that matches the roll of Cube 2. Then use the rule to figure out and write the number that should be in the other row.

a.

+15	IN						
	OUT						

b.

-12	IN						
	OUT						

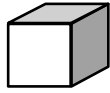
c.

+19	IN						
	OUT						

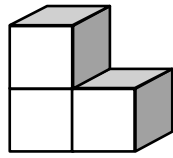
d.

-21	IN						
	OUT						

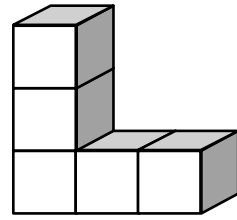




Building 1



Building 2



Building 3



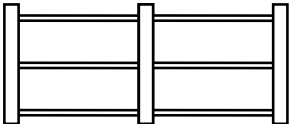
What does the 8th building look like?

How high is the building with 10 blocks along the base?

How many blocks are there altogether in that building?

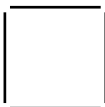


Which building has a total of ____ blocks?

Relationship patterns

	Number of posts	Number of rails
	1	0
	2	2
	3	4
	4	

How many rails will be required for 12 posts?

How many rails will be required for 50 posts?

	Number of squares	Number of matches
	1	4
	2	7
	3	
	4	

How many matches will be required to make 10 squares?

How many matches will be required to make 50 squares?

Write in words how to work out the number of matches required to make any number of squares.

What strategies are likely to be extended beyond the number fact range?

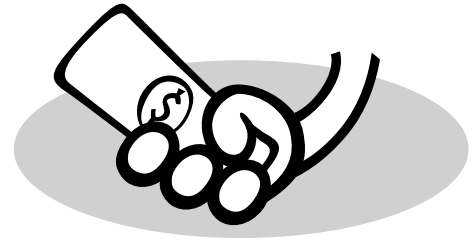
Addition

- Count-on 1, 2 and 0
- Doubles and near doubles
- Bridge to ten

Multiplication

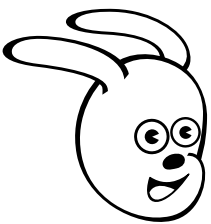
- Use tens (5s)
- Make generalizations (1s and 0s)
- Use Doubles (2s, 4s and 8s)
- Build up/down (9s and 6s)

Gemma had \$5. Her mother gave her \$1 more. How much money does she have?



1. Write the number fact.

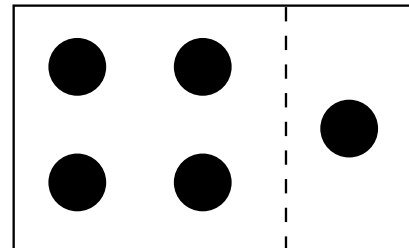
$$\underline{5} + \underline{\quad} = \underline{\quad}$$



How did you figure it out in your head?

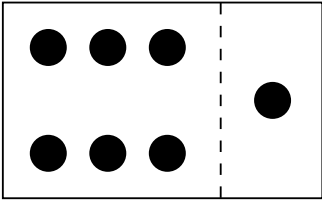
2. Look at this count-on card. Complete the number fact.

$$\underline{4} + \underline{1} = \underline{\quad}$$



3. Write a number fact for each of these. Write the turnaround fact.

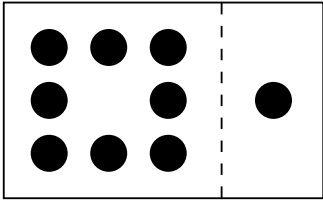
a.



$$\underline{\quad} + \underline{\quad} = \underline{\quad}$$

$$\underline{\quad} + \underline{\quad} = \underline{\quad}$$

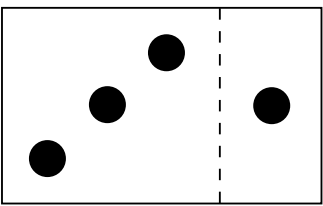
b.

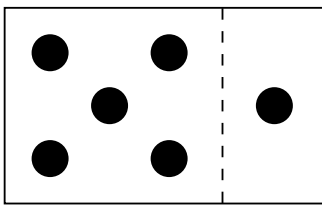


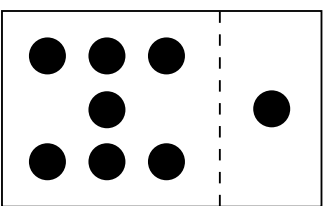
$$\underline{\quad} + \underline{\quad} = \underline{\quad}$$

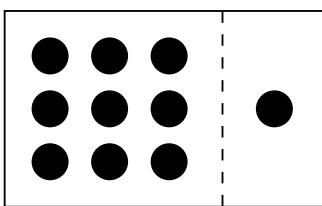
$$\underline{\quad} + \underline{\quad} = \underline{\quad}$$

1. Write a number fact to show each total.

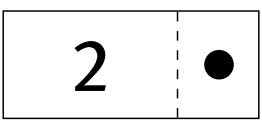
a. 
 _____ + _____ = _____

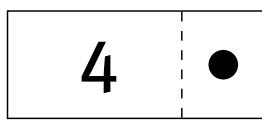
b. 
 _____ + _____ = _____

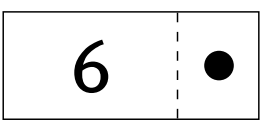
c. 
 _____ + _____ = _____

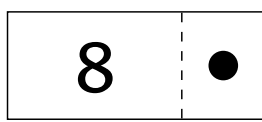
d. 
 _____ + _____ = _____

2. Write the number fact then write the turnaround fact.

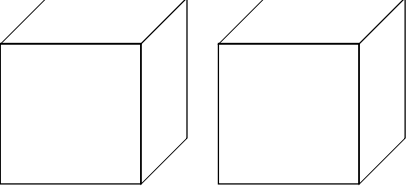
a. 
 _____ + _____ = _____
 _____ + _____ = _____

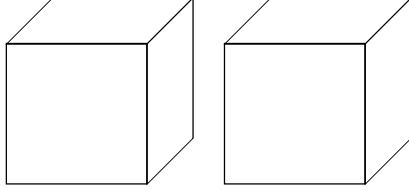
b. 
 _____ + _____ = _____
 _____ + _____ = _____

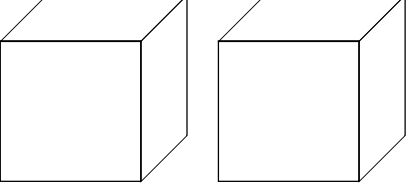
c. 
 _____ + _____ = _____
 _____ + _____ = _____

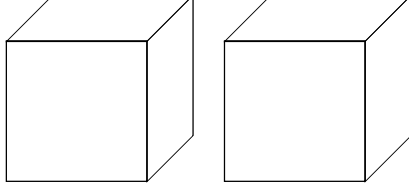
d. 
 _____ + _____ = _____
 _____ + _____ = _____

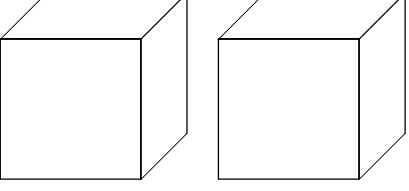
- Roll your number cubes and count on 1 or 2.
- Find your answer below.
- Write your numbers on the number cubes. Write the number fact.

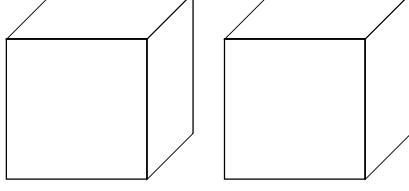


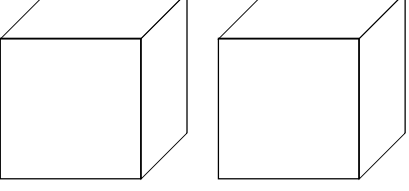
$$\underline{\quad} + \underline{\quad} = 11$$


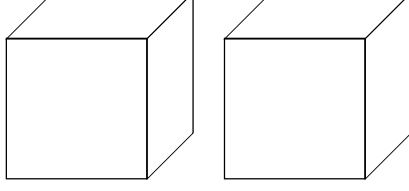
$$\underline{\quad} + \underline{\quad} = 6$$


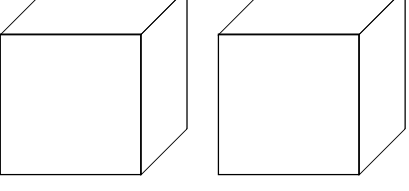
$$\underline{\quad} + \underline{\quad} = 5$$


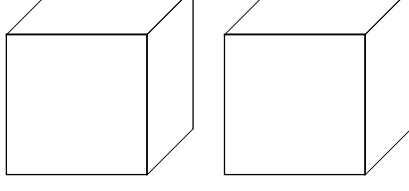
$$\underline{\quad} + \underline{\quad} = 8$$


$$\underline{\quad} + \underline{\quad} = 9$$








$$\underline{\quad} + \underline{\quad} = 7$$


$$\underline{\quad} + \underline{\quad} = 8$$


$$\underline{\quad} + \underline{\quad} = 6$$


$$\underline{\quad} + \underline{\quad} = 7$$


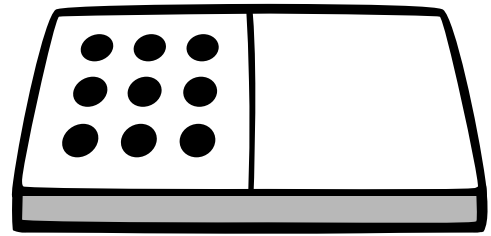
$$\underline{\quad} + \underline{\quad} = 10$$

Cube A: 4, 5, 6, 7, 8, 9
Cube B: , , , , , 

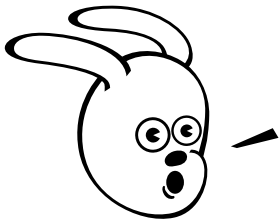
Addition Chart

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

1. Draw dots on this domino to show double 9.



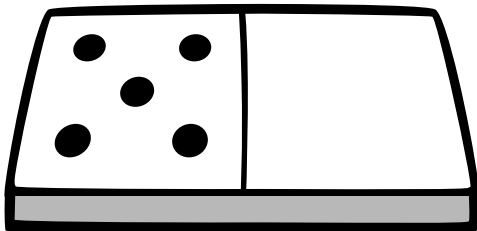
Write the number fact.

$$\underline{\quad\quad} + \underline{\quad\quad} = \underline{\quad\quad}$$


How did you figure out double 9 in your head?

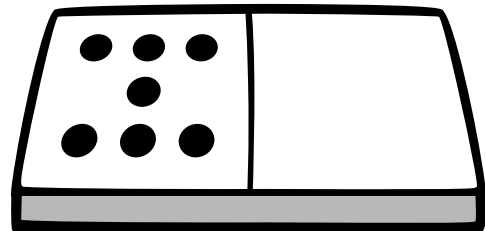
2. For each of these, draw dots to show a double.
Write the double fact.

a.



$$\underline{\quad\quad} + \underline{\quad\quad} = \underline{\quad\quad}$$

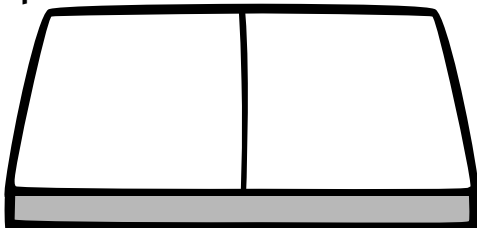
b.



$$\underline{\quad\quad} + \underline{\quad\quad} = \underline{\quad\quad}$$

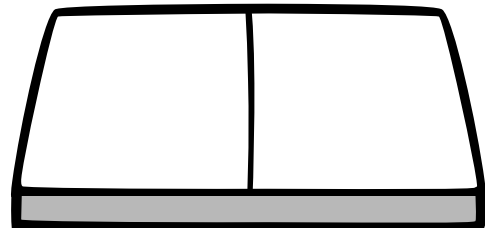
3. Draw dots to show the doubles that have these answers.
Complete the number facts.

a.



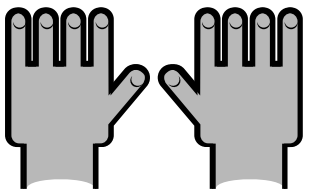
$$\underline{\quad\quad} + \underline{\quad\quad} = 16$$

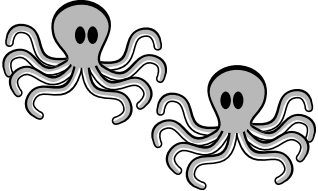
b.

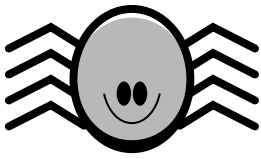


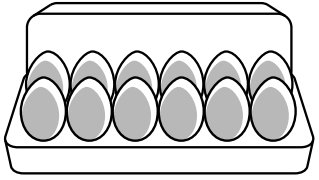
$$\underline{\quad\quad} + \underline{\quad\quad} = 8$$

1. Complete the double fact for each of these.

a. 
 _____ + _____ = _____

b. 
 _____ + _____ = _____

c. 
 _____ + _____ = _____

d. 
 _____ + _____ = _____

2. Write the double facts that have these answers.

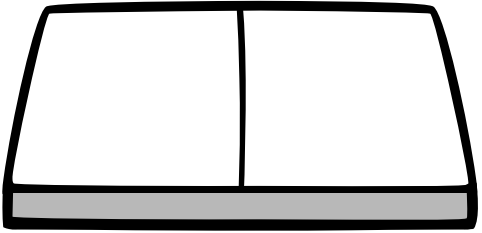
a. $14 = \underline{\quad} + \underline{\quad}$

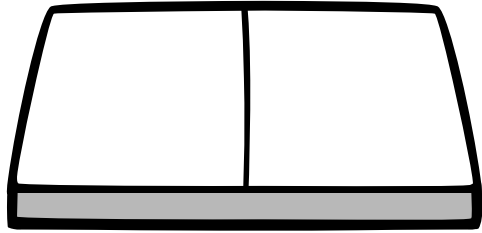
b. $20 = \underline{\quad} + \underline{\quad}$

c. $4 = \underline{\quad} + \underline{\quad}$

d. $18 = \underline{\quad} + \underline{\quad}$

3. Draw dots on these dominoes to show other doubles. Write the facts.

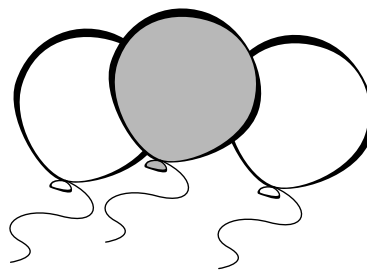
a. 
 _____ + _____ = _____

b. 
 _____ + _____ = _____

11	19	13	15
13	9	17	19
17	11	15	9

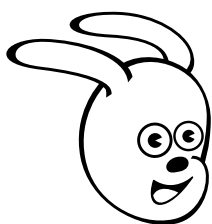
Cube: 4, 5, 6, 7, 8, 9

Jade had 9 girls and 6 boys at her party.
How many guests in all?

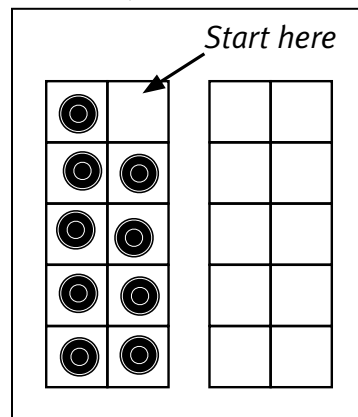


1. a. These ten-frames show 9 counters.
Draw 6 more counters.

b. Write the total. _____



What did you notice?

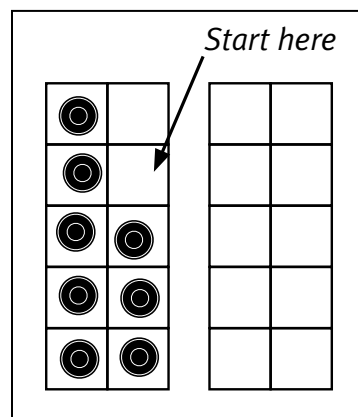


c. Complete the sentence.

$9 + 6$ is the same as $10 +$ _____

2. a. These ten-frames show 8.
Draw 4 more counters.

b. Write the total. _____



c. Complete the sentence.

$8 + 4$ is the same as $10 +$ _____

1. Draw more counters then complete the sentence.

a. Draw 7 more

●			
●	●		
●	●		
●	●		
●	●		

$\overset{9}{\text{---}} + \text{---}$
is the same as
 $\overset{10}{\text{---}} + \text{---} = \text{---}$

b. Draw 5 more

●			
●	●		
●	●		
●	●		
●	●		

$\overset{9}{\text{---}} + \text{---}$
is the same as
 $\overset{10}{\text{---}} + \text{---} = \text{---}$

c. Draw 5 more

●			
●			
●	●		
●	●		
●	●		

$\text{---} + \text{---}$
is the same as
 $\text{---} + \text{---} = \text{---}$

d. Draw 3 more

●			
●			
●	●		
●	●		
●	●		

$\text{---} + \text{---}$
is the same as
 $\text{---} + \text{---} = \text{---}$

2. For each of these, draw an arrow to a number sentence below that has the same answer. Write the answer.

a. $9 + 8$

b. $8 + 6$

c. $9 + 3$

$10 + 2 = \text{---}$

$10 + 7 = \text{---}$

$10 + 4 = \text{---}$





- Roll your number cubes and write the fact below the example in the grid that will help you figure out the answer.
- Write the answer to both facts.

$10 + 6 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 6 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$
$10 + 5 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 5 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$
$10 + 5 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 5 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$
$10 + 4 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 4 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$
$10 + 4 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 4 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$
$10 + 3 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 3 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$
$10 + 3 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 3 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$
$10 + 2 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 2 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$
$10 + 1 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$	$10 + 1 = \underline{\quad}$ $\underline{\quad} + \underline{\quad} = \underline{\quad}$

Cube A: 8, 8, 8, 9, 9, 9

Cube B: 3, 4, 5, 5, 6, 7

Cat and Mice

5		1		5		1
4	3	2	3	4	3	2
2	1	3	1	2	1	3
1	4	2	5	3	4	1
2	1	3	1	2	1	3
4	1	2	3	4	1	4
2	3	1		5	3	2
1	4	2	3	2	4	1
HOME	HOME	HOME	HOME	HOME	HOME	HOME

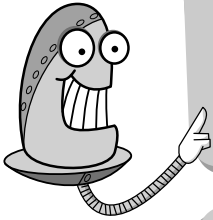
Materials: 2 standard dice

Using Tens to Multiply by 5

Write the answer to the tens number fact.

Color half the picture and then write a number fact to match what you colored.

The first one has been colored for you!



a.

$3 \times 10 = \square$

$3 \times 5 = \square$

b.

$2 \times 10 = \square$

$2 \times 5 = \square$

c.

$7 \times 10 = \square$

$\square \times \square = \square$

d.

$6 \times 10 = \square$

$\square \times \square = \square$

e.

$9 \times 10 = \square$

$\square \times \square = \square$

f.

$8 \times 10 = \square$

$\square \times \square = \square$



Write a tens fact you could use to work out each of these:

a. $4 \times 5 = \square$ b. $12 \times 5 = \square$ c. $16 \times 5 = \square$

Nice and Easy

30×3	50×3	70×3	90×3
30×4	50×4	70×4	90×4
30×6	50×6	70×6	90×6
30×7	50×7	70×7	90×7
30×8	50×8	70×8	90×8
30×9	50×9	70×9	90×9

Cube A: 15, 15, 25, 35, 45, 45

Cube B: 6, 8, 12, 14, 16, 18

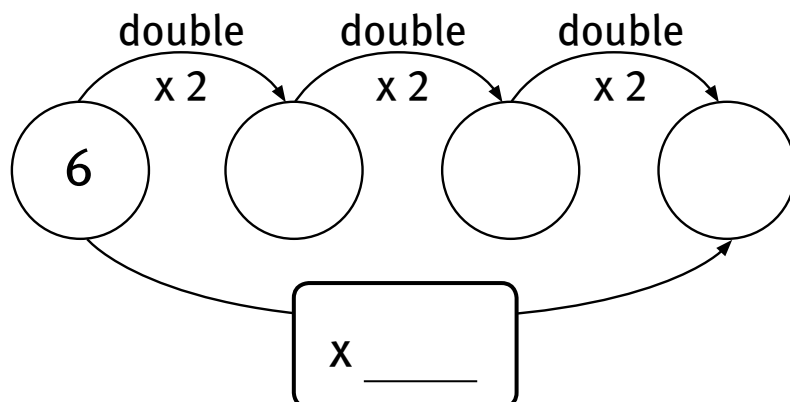
Nice and Easy Too!

90	150	210	270
120	200	280	360
180	300	420	540
210	350	490	630
240	400	560	720
270	450	630	810

Multiplication Chart

X	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

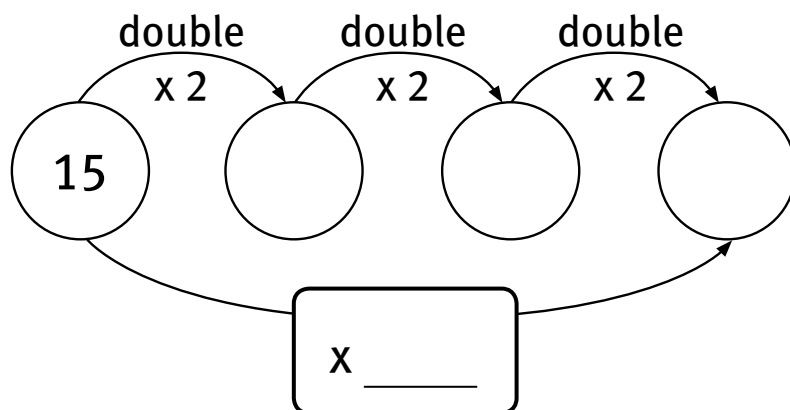
1. a. Double 6, then double and double again.
Write the answers in the circles.



- b. Write a number in the box above.

- c. Write the number sentence.

$$6 \times \underline{\quad} = \underline{\quad}$$



2. a. Complete this picture.

$$15 \times \underline{\quad} = \underline{\quad}$$

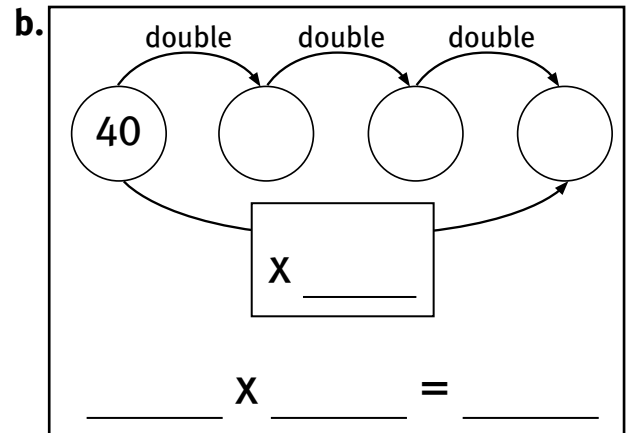
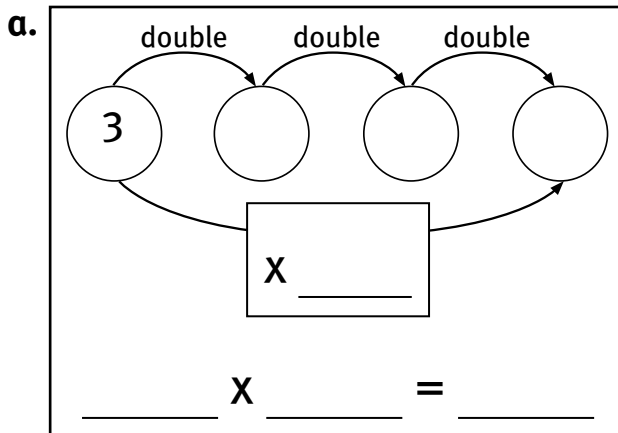
- b. Write the number sentence.

3. Write other number sentences you could solve using this method.

a. $\underline{\quad} \times 8 = \underline{\quad}$

b. $\underline{\quad} \times 8 = \underline{\quad}$

1. Complete each picture. Write the number sentence.



2. Double double double each of these numbers in your head. Complete the number sentence and its turnaround.

a. $30 \times 8 = \square = \square \times \square$

b. $110 \times \square = \square = \square \times \square$

3. Write the OUT and IN numbers.

