

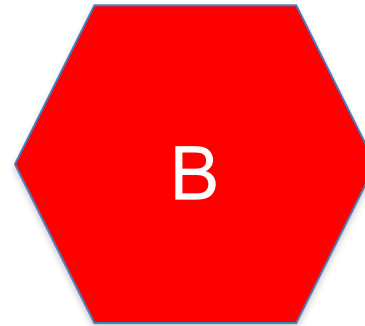
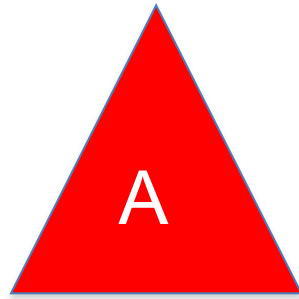
Critical Thinking in Math Gr 3 – 6

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Let's get started

- A third shape is **more like** shape A than shape B.
- What might it look like?





What is critical thinking?

- Review, analysis and assessment of information from different points of view
- There is always an element of setting criteria/making decisions in order to do the analysis and assessment.



Estimation

- Which is a **better** estimate for $344 - 126$?
- $340 - 130$
- $345 - 125$
- $350 - 130$



Fractions

- A fraction is just a **bit more** than $\frac{1}{2}$.
- What might it be?



Asking the right questions

- Why might someone say it is more useful to know how to add than how to subtract?
- Why might someone say it is more useful to know how to subtract than how to add?



Asking the right questions

- Is a shape's area or perimeter a **more important** aspect of the shape?
- What are the criteria for “important”?



We always start with curriculum

- Let's look at the content to be covered and see if we can develop critical thinking approaches.



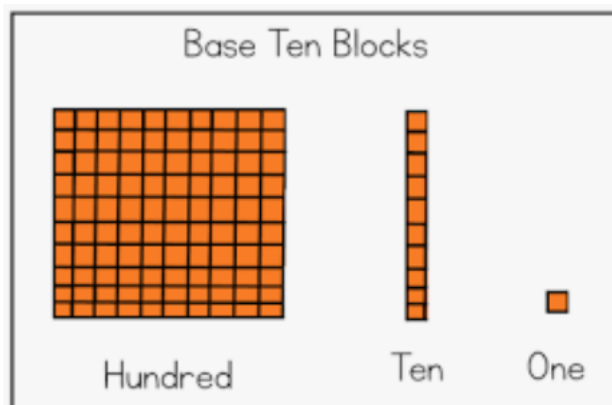
Grade 3

- Representing whole numbers



Maybe

- What numbers between 100 and 150 can you represent with exactly 12 base ten blocks?
- How do you know you have all of them?





They are

- 102
- 111
- 120
- 129
- 138
- 147



Or

- Look at the number 504.
- Why might you argue 5 is the most important digit?
- Why might you argue for 0?
- Why might you argue for 4?



Grade 3

- Addition and subtraction to 1000



Maybe

- You subtract a 3-digit number from another 3-digit number.
- Is the result more likely to be a 1-digit number, a 2-digit number, or a 3-digit number?
- Explain.



Maybe

- You add two numbers and the answer is slightly more than triple the first number.
- What could the numbers be?



Maybe

- You add two numbers.
- You subtract the same two numbers.
- The add answer is close to 100 more than the subtract answer.
- What could the numbers be?



Grade 3

- Multiplication and division



Maybe

- Sarah solved a division story problem.
- Do you think she could have solved it using subtraction?
- Show what you mean.

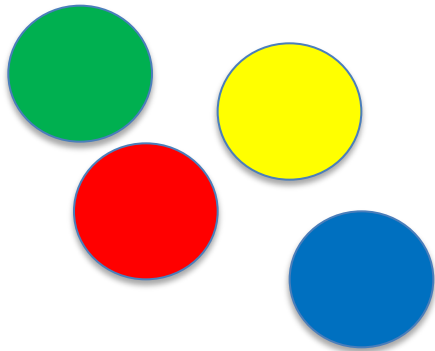
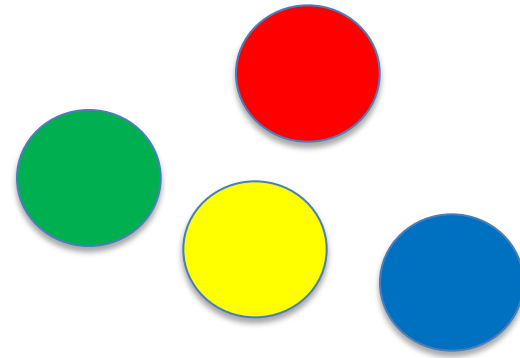
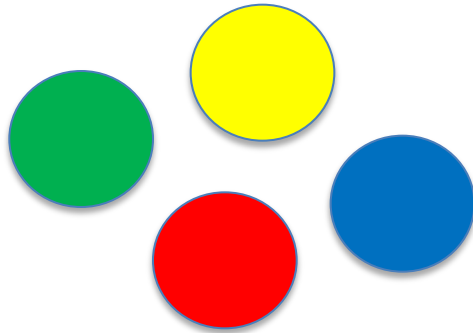


Maybe

- Draw a picture that is not an array, but still helps me see that $4 \times 3 = 3 \times 4$.



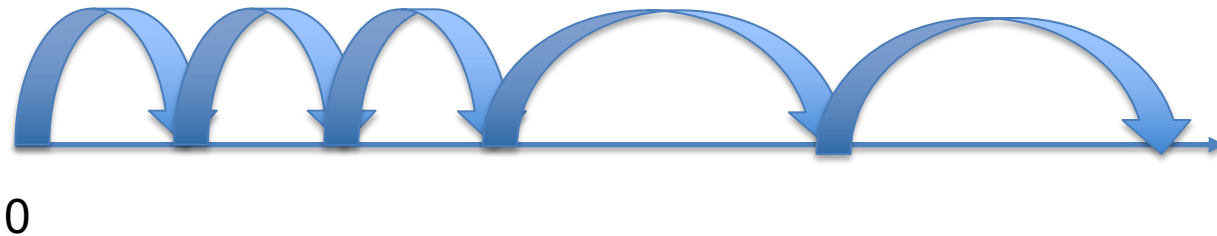
Maybe





Maybe

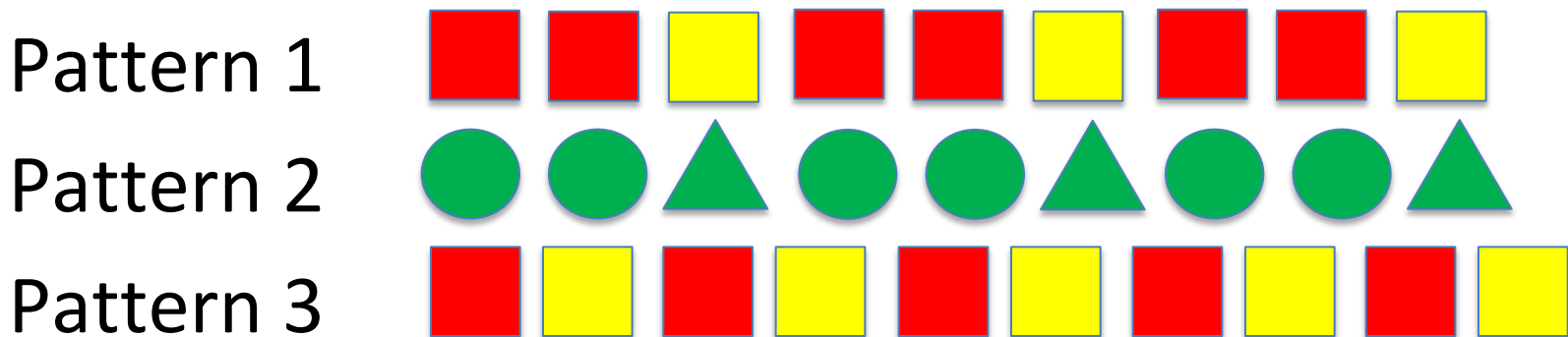
- What computation do you think this might be? Why?





Grade 3

- Why might you argue that Patterns 1 and 2 are more alike than Patterns 1 and 3?
- Why might you argue that Patterns 1 and 3 are more alike than Patterns 1 and 2?





Grade 4

- Compare and order numbers to 10 000



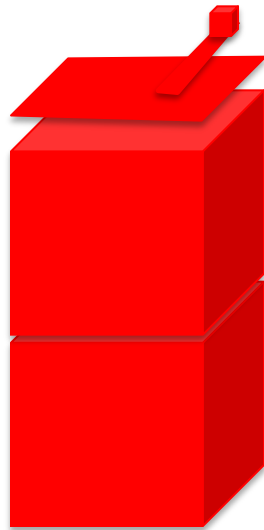
One idea

- When is $4 \times 29 > 9 \times 221$?
- When is it less?



OR

- You build base ten block towers by putting large blocks on bottom, then flats, then sticks, then units.





- Does a higher tower always represent a greater number? When does it or does it not?



OR

- What might be reasonable values for the dots on the number line?





Grade 4

- Addition and subtraction



Maybe

- For a particular two numbers, you say it's easier to subtract them if you add 3 to both numbers.
- What might the numbers be?



Maybe

- You add two numbers that are not too far apart and the sum is 545.
- What are good choices for the two numbers?
- Why are they good choices?



Grade 4

- Compare and order fractions



An idea

- Compare and contrast the strategies you would use to compare

$2/3$ to $7/3$

$2/3$ to $2/5$

$2/3$ to $1/10$

$2/3$ to $4/5$



Another idea

- Consider the two fractions: a/b and c/d .
- Is it true that a/b is usually more than c/d if a and b are closer together than c and d ?



Another idea

- Is it true that when you compare two fractions, if you use an in-between numerator and an in-between denominator, you get an in-between fraction?

(e.g. Between $\frac{4}{5}$ and $\frac{8}{9}$ is $\frac{6}{7}$)



Grade 4

- Multiplication and division



Maybe

- You are dividing a 2-digit number by a 2-digit number and you think it's pretty easy to do in your head.
- What might you be dividing?



Maybe

- What multiplication facts do you think are most critical to help you figure out the others?



Grade 4

- Probability



Maybe

- You are planning a spinner and predict that you will spin red a bit more than you spin yellow.
- What might the spinner look like?



Grade 5

- Place value



Grade 5

- Write two 5-digit or 6-digit numbers that would take a lot of words to say.
- Write two 5-digit or 6-digit numbers that would not take a lot of words to say.



Grade 5

- Subtracting



Maybe

- Without calculating, do you know whether $4 \times 83 - 21 \times 11$ is greater than $72 \times 11 - 5 \times 11 \times 11$ apart? Explain.



Grade 5

- Divide three-digit whole numbers by one-digit whole numbers....



One possible question

- Is it true that every division question can be solved by using multiplication instead?



Another possible question

- When you divide 412 by 4, you can write $412 = 400 + 12$ and divide each part by 4 and add.
- But you can't write $4 = 2 + 2$ and divide 412 by 2 and then 2 and then add.
- Why is that?



Or

- We write $24 \div 4$ to ask for the size of a group when 24 is divided into 4 equal groups.
- We also write $24 \div 4$ to ask for how many groups we can make if 24 is divided into groups of 4.
- Do you think we should use a different symbol in the two situations?



Grade 5

- Fractions



Maybe

- Draw a picture to show why $6/9 = 8/12$.



Maybe





Maybe



Grade 5

- Fractions



Maybe

- $\Delta/8$ is a little less than $\Delta/9$.
- What could those values be?



Grade 5

- Investigating shapes based on multiple attributes



Maybe

- A shape has some long sides and a lot of short sides.
- What other information do you know about the shape?



Grade 5

- Perimeter



Maybe

- One shape on a geoboard touches 10 pegs with 3 pegs inside.
- Another touches 12 pegs with 4 pegs inside.
- Which has more area?



Grade 5

- Time



Maybe

- A movie theatre is showing a film that is 124 min long on a Saturday.
- What would be good start and end times to show it many times in the day?



Grade 6

- Deriving formulas



One idea

- One rectangle has half the area of another.
- Would the perimeter also be half?
- Is it ever? Usually? Often?



Another idea

- A rectangle's length is twice its width.
- What do you know, for sure, about its area and perimeter?



Another idea

- Create rectangles where the number of centimetres in the perimeter is very close to the number of square centimetres in the area.



Grade 6

- Identify triangles and classify them according to angle and side properties
- Construct triangles using a variety of tools....



One idea

- Can an angle with a 120° angle be isosceles?
Right? scalene?



Another idea

Which is easiest to construct?

- An equilateral triangle
- An isosceles triangle with one angle of 40°
- A scalene triangle with side lengths of 4 cm, 5 cm and 6 cm
- A right triangle with a 35° angle



Another idea

- You are going to construct a triangle where one angle is double another.
- What kinds of triangles can you construct? Which can't you?



Grade 6 expectation

- Percents



One idea

- Is 10% a lot or not?

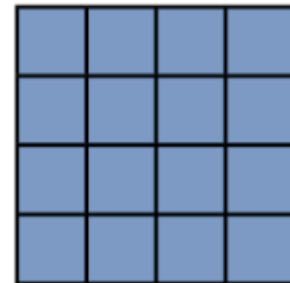
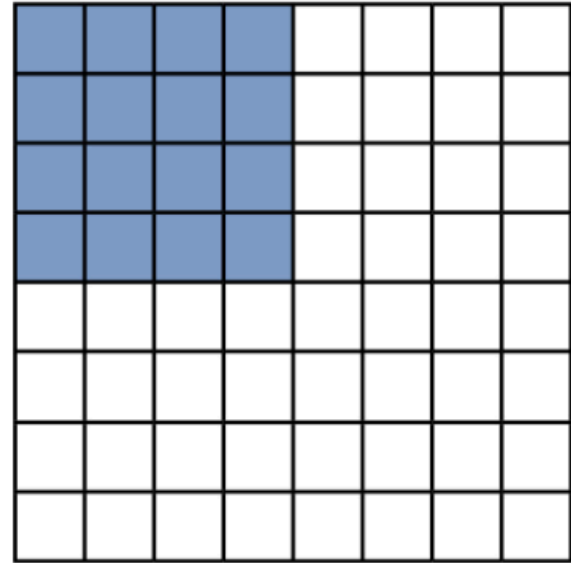
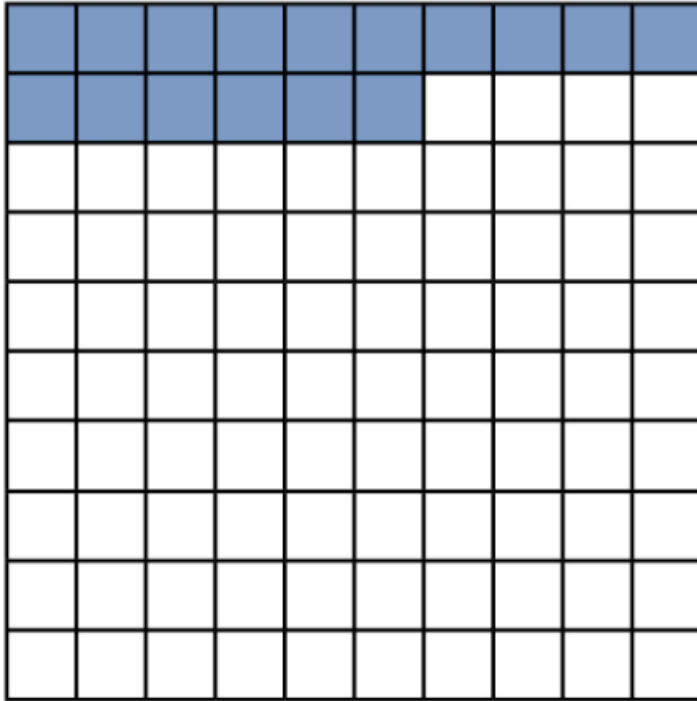


Another idea

- If you know 25% of an amount, what other percents of it do you also know?
- Which don't you know?



Which grid or grids show percent?





A few more examples

- Which pattern gets to 1000 first? How do you know?
- 15, 25, 35, 45, 55, 65,...
- 500, 502, 504, 506, 508,...



A few more examples

You are multiplying a number by 9.

Then you multiply the next number (one more) by 9.

What happens to the ones digit? Why?



A few more examples

Do you think squares or rhombuses are better shapes to use as floor tiles? Why?



A few more examples

- Which fraction doesn't belong? Why?

$3/4$

$3/5$

$1/3$

$5/7$



A few more examples

- What other numbers go with the given ones?
- 114, 99, 57
- 59, 2, 101



Or

- How are these alike and how are they different?
 - Multiplying 32×43 or 8×43
 - The fraction $\frac{2}{3}$ and the ratio 2:3
 - The decimals 0.42 and 0.24



Or

- You perform a reflection and some points on the original shape move A LOT and some not much at all.
- Every point moves some.
- What could the initial position and final position look like?



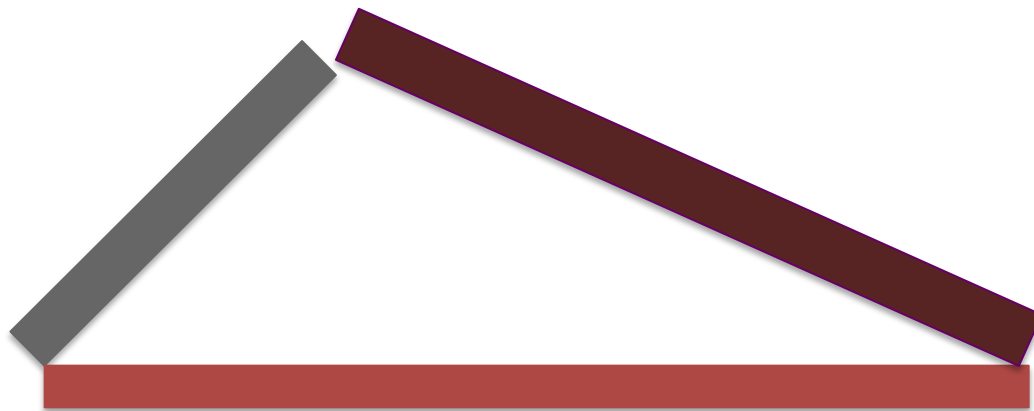
Another example

- You roll two dice and form a two-digit number with the results.
- Which is more likely?
- That the number is a multiple of 3 or that it is a multiple of 4? Why?



Or

- You pull 3 Cuisenaire rods at random from a bag.
- Is it more likely that you can or cannot form a triangle?





Another example

- Sometimes we write $P = 2l + 2w$ and sometimes we write $P = 2(l + w)$ to determine the perimeter of a rectangle.
- Why do these really say the same thing?
- Which is more useful when?



In summary

- It really is possible to link the goal of eliciting critical thinking with the content to be covered in Grades 3 – 6.



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