WHAT DO WE OWE OUR STUDENTS?

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Equity

- One piece, and an important one, is that we owe EACH student our very best as a teacher.

Naturally

- that means a caring, nurturing environment where we listen to kids, respond to them, help them etc.,
- But what else?

Reflective teaching

- We are teachers. That involves a professional responsibility to deeply consider what and how we are going to teach math, whether math is our favourite subject to teach or not.

Reflective teaching

- It means attending to individual needs and attending to student interest, but it’s more than that.

You may have been asked:

- Do you say that you teach math or do you say that you teach kids?

My response

- I think we HAVE to say “I teach math to kids.”
- I need to think about their needs, but I also need to think about what I think they should learn.
- And it’s not as easy as saying- whatever the curriculum says.

It means reading the curriculum..

- but really analyzing what should be the focus.
- What sorts of tasks?
- What sorts of assessments?

This talk..

- will focus on that latter piece, not because it is the only important piece, but it is a piece we often don’t look at enough.

We will look at examples

- at many grade levels in different strands.

Grade 1

- **B1.2**
- compose and decompose whole numbers up to and including 50, using a variety of tools and strategies, in various contexts

Teaching Supports

Key concepts

- Numbers are composed when two or more numbers are combined to create a larger number. For example, twenty and five are composed to make twenty-five.
- Numbers are decomposed when they are taken apart to make two or more smaller numbers that represent the same quantity. For example, 25 can be represented as two 10s and one 5.

Then what?

- Those were a bit more of definitions than telling you where to focus.
- You have to decide whether it's just that they can compose and decompose using various tools and in various contexts or whether there are other pieces, e.g.

What’s involved in composition/decomposition?

- Why/when do we decompose?
- How do we move from one decomposition to another?
- Is the focus on place value decompositions or other ones too?

What’s involved in composition/decomposition?

- Is it only two pieces or more?
- Must they explicitly relate composition/decomposition to addition and subtraction or not?
- What contexts? Do there have to be contexts?
- Is this topic linked to other strands?

Then….

- So which of these do I emphasize in instruction?
- Which of these do I emphasize in assessment?
- How much do I worry about the 50 (e.g. what if they can do it to 20 or 30?)

Assessment

- How do I assess? What sorts of tasks or questions do I use?

They can look pretty different

- Compare:

- Decompose 43 into tens and ones.
- 43 = ___ tens + ____ ones
- Decompose 43 in many ways.

They can look pretty different

- OR EVEN
- When might you decompose 45 without my telling you to? Why would you do it?

They can look pretty different

- OR
- 32 = 30 + 2
- How does that help you figure out the missing number?
- 32 = 28 + []?

They can look pretty different

- OR
- How could you decompose 53 into a LOT of pieces?
- How many could it be?

They can look pretty different

- OR
- How could you decompose 53 into two small and one big piece?

Two different teachers

- as you can see, might have very different beliefs of what it means to meet that expectation.

I think each of us owes our students

- to at least consider these options and choose one thoughtfully.

Grade 5

- **D1.5**
- determine the mean and the median and identify the mode(s), if any, for various data sets involving whole numbers and decimal numbers, and explain what each of these measures indicates about the data

Key concepts

- The mean, median, and mode can be determined for quantitative data. Only the mode can be determined for qualitative data.
- A variable can have one mode, multiple modes, or no modes.
- The use of the mean, median, or mode to make an informed decision is relative to the context.

Then what?

- You have to realize these measures were introduced earlier (mode in G2, mean in G3, median in G4).
- Is the focus on what each is or is the focus on what the measures really tell us?

What might you want them to think about?

- Why do we have 3 different measures of central tendency?
- What makes one better than another in a particular situation?
- What does better even mean?

Do you want?

- Starting from the data and getting the measures or starting from the measures and getting the data or both?
- How do you want students to compare the values for a set of data--- simply which is more or less or multiplicative or additive comparisons?

As I said earlier…

- So which of these do I emphasize in instruction?
- Which of these do I emphasize in assessment?

Assessment tasks/questions can look pretty different

- Compare:
- What are the mean, median and mode of …….?
- (Can I use simple data sets with small numbers, or must there be bigger whole or decimal values?)

They can look pretty different

- I might ask:
- The mean of this data set is 40.
- What values might be missing?

- 2, 10, 16, ____, _____ ?

They can look pretty different

- I might ask:
- Describe a situation where you think the mean is a better description of a set of data than a median.

They can look pretty different

- OR
- Why would someone choose to report a mean or median or mode?
- Which is more generally reported in the media?

They can look pretty different

- OR
- Why are the mean or median more likely to be used than the mode?

They can look pretty different

- OR
- Can there be two different data sets with the same median and mean and mode?

They can look pretty different

- OR
- Can a median be bigger than a mean? When?
  Can it be smaller? When?

Again, what we owe our students…

- is consideration of these options and a thoughtfully made decision that we could explain to someone (e.g. our principal or a colleague or a parent) if asked

Grade 3

- **C1.2**
- create and translate patterns that have repeating elements, movements, or operations using various representations, including shapes, numbers, and tables of values
- [There are other expectations about describing and extending.]

Key concepts

- The same pattern structure can be represented in various ways.
- Patterns with a repeating element can be based on attributes (e.g., colour, size, orientation).
- Patterns with a repeating operation can be based on repeating operations of addition, subtraction, multiplication, and/or division.
- Pattern structures can be generalized.
- When translating a pattern from a concrete representation to a table of values, each iteration of the pattern can be referred to as the term number, and the number of elements in each iteration can be referred to as the term value. In a table of values, the term number is shown in the left-hand column and the term value is shown in the right-hand column.

Then what?

- As I read this, I wonder the difference between: Pattern structure can be represented in various ways. AND
- Pattern structures can be generalized.

Then what?

- It looks like we should use tables of values and language like term number and term value, but you need to think about how and when and why.
- It looks like we should deal with repeating and growing patterns.

Then what?

- At first, it looks like we should deal with growing patterns involving all four operations, but not sure sure since they would not grow if we use subtraction or division.

You must think about…

- what sorts of requirements you will impose on the creation of patterns.
- Will you describe the repeating structure or tell what operation or tell the 1st term or tell the 10th term or provide some other condition?
- Or will it vary from student to student?

More to think about

- How do you translate repeating patterns as compared to growing patterns?
- Do I talk to students about that?
- Do I need them to use the word “translate”?

More to think about

- How are you going to motivate the need to create repeating patterns?
- Growing patterns?
- Are you going to link to other strands to do that?

Assessment tasks/questions can look pretty different

- Compare :
- Translate 3, 5, 7, 9,….into a pattern involving shapes.
- TO
- Which way of representing the pattern 3, 5, 7, 9,…. helps you best see what the 20th term might be? Why?

They can look pretty different

- Compare:
- Create a growing pattern where the 1st term is 10. TO
- Create a growing pattern where 35 and 42 would both be terms.

They can look pretty different

- OR, instead,
- Create two growing patterns, each including the number 220, but one grows much faster than the other.

Is there value in “communal” (in a school) consideration of these issues?

- Do you think that it might help kids if teachers in the same school thought about some of these sorts of issues together?

Grade 9

- – identify, through investigation, properties of the slopes of lines and line segments (e.g., direction, positive or negative rate of change, steepness, parallelism, perpendicularity), using graphing technology to facilitate investigations, where appropriate.

We know this will change, but..

- Right now there are no teaching supports, so teachers are completely on their own figuring out where to focus.

What do you think matters here?

- The “look” of positive and negative slopes
- Relating slope to rate of change in a contextual situation or just on a graph?

What do you think matters here?

- Knowing that parallel lines have the same slope or why they do?
- Knowing that the product of slopes of perpendicular lines is -1 or why that is?
- Being able to “estimate” the look of a line with a particular slope on a particular set of axes?

What do you think matters here?

- Knowing that it is the m in $y=mx + b$ that is the slope?
- Knowing that it is $-A/B$ in the equation $Ax + By + C = 0$ that is the slope?

What do you think matters here?

- Being able to explain why lines have constant slope but other curves don't?
- Being able to explain why slope and intercept are independent values

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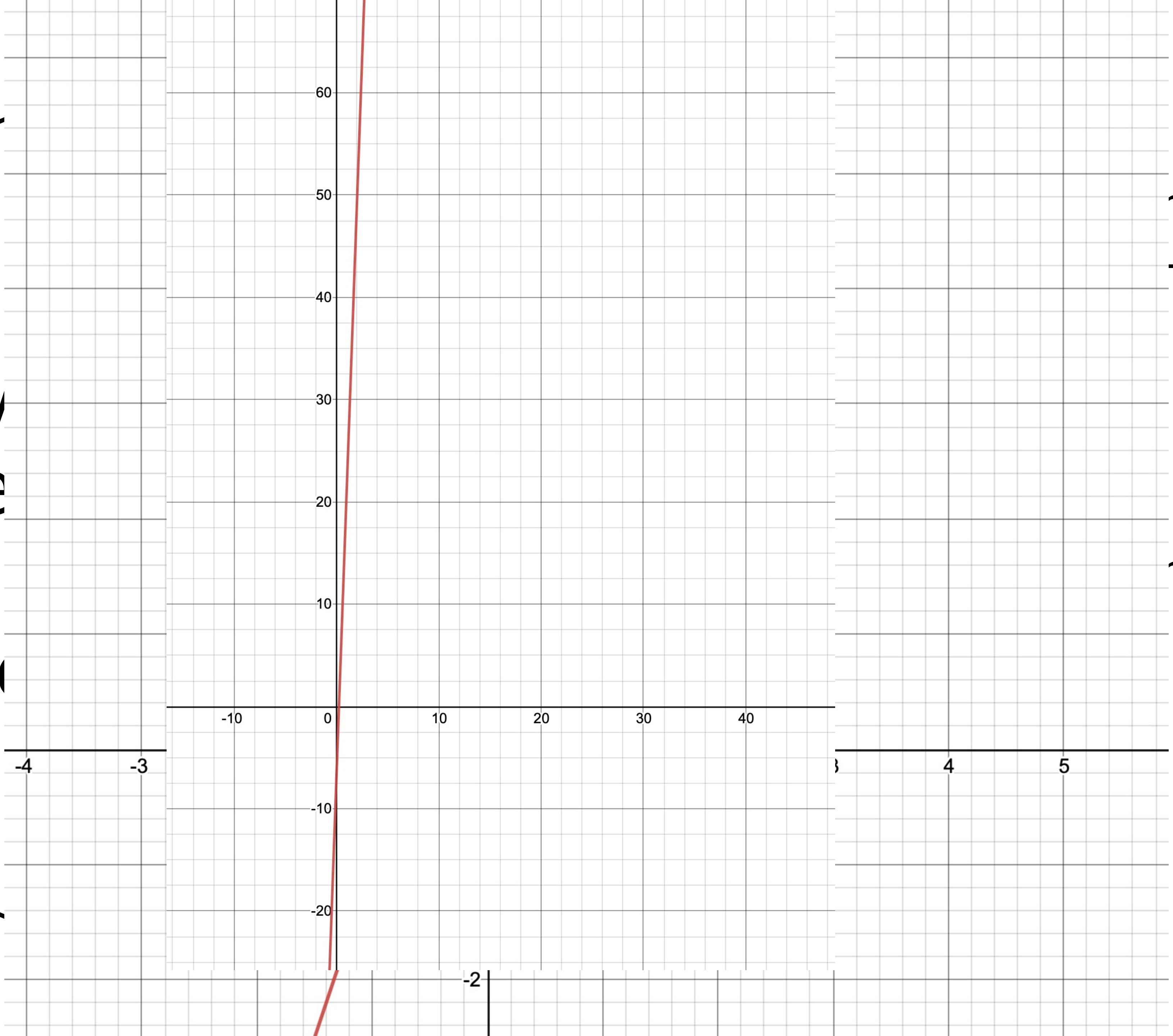


So you might ask very different assessment questions

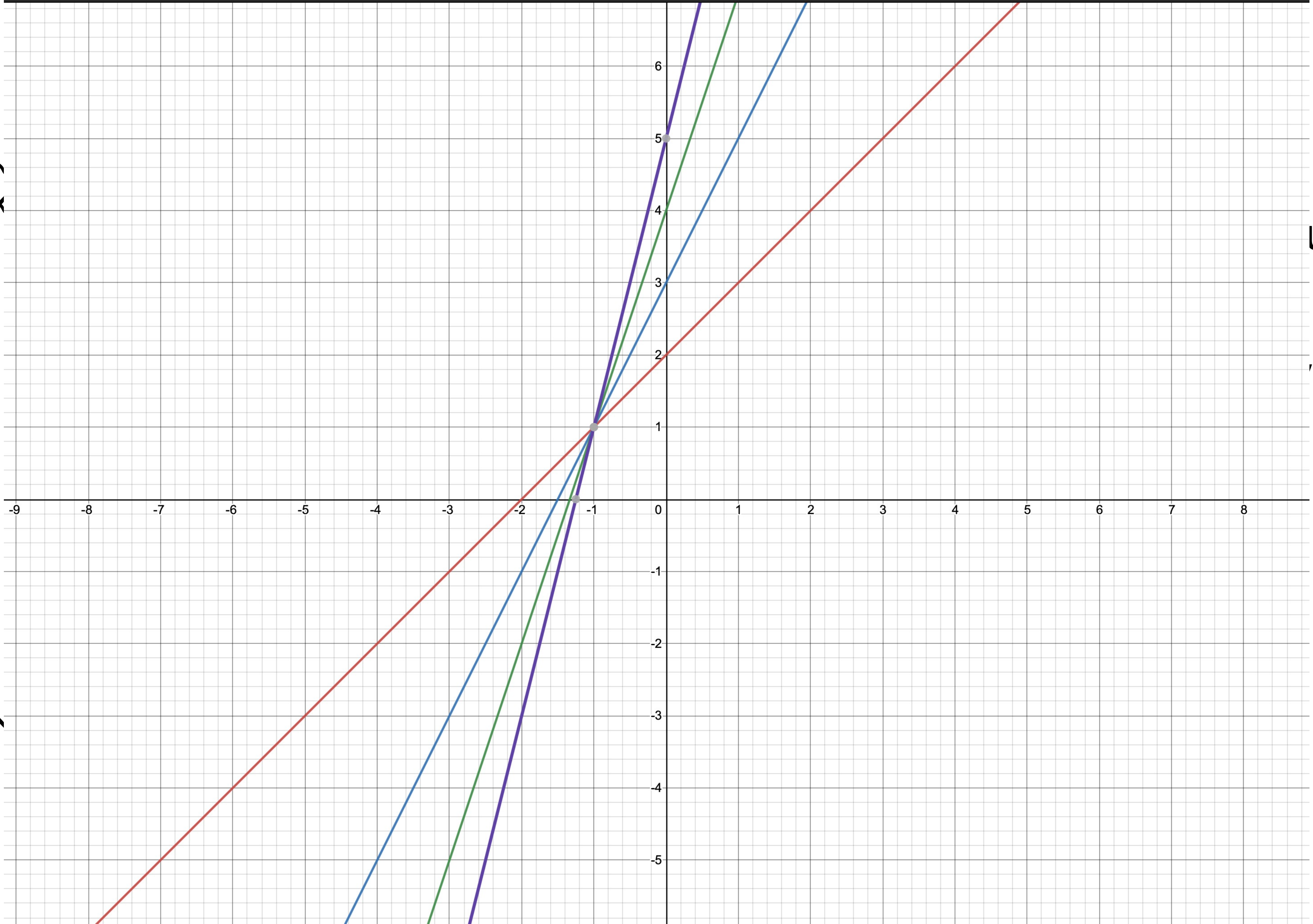
- A line through (4,1) is parallel to $y = 3x - 2$. What is the equation?
- Vs
- Why do parallel lines have to have the same slope?

So you might ask very different assessment questions

- A line through (4,1) is perpendicular to $y = 3x - 2$. What is the equation?
- Vs
- One line has a slope of 4. Another has a slope of -0.23.
- Estimate the angle where they cross.

So you might ask very different assessment questions

- Can two lines have the same slope but different x-intercepts?
- Can two lines have the same slope but different y-intercepts?
- Why do you need two pieces of information to graph a line?



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Grade 7

- **E1.1**
- describe and classify cylinders, pyramids, and prisms according to their geometric properties, including plane and rotational symmetry

Key concepts

- A geometric property is an attribute that helps define a class of objects.
- Cylinders, pyramids, and prisms represent three broad categories of three-dimensional objects.
- There are many attributes that are used to distinguish and define sub-categories or classes of objects, including:
  - the shape of the base or bases;
  - the number of bases;
  - the number of edges and vertices;
  - whether the object is symmetrical (e.g., whether it has rotational or plane symmetry);
  - whether the faces are perpendicular to the bases.
- Three-dimensional objects can have rotational symmetry (when an object can rotate around an axis and find a new spin position that matches its original position) and plane symmetry (when an object can be split along a plane to create two symmetrical parts). Generating property lists and using them to create geometric arguments builds spatial sense. Minimum property lists identify the fewest properties needed to identify a class (e.g., if a prism has only one plane of symmetry, it must be an oblique prism). The following is a list of some properties for cylinders, prisms, and pyramids.

Then what?

- As I read this, I see that I should deal with right prisms, pyramids and cylinders as well as oblique ones (whether faces are perpendicular to bases).
- I should deal with plane and rotational symmetry.

Then what?

- It seems that I should deal with numbers of faces, vertices, edges, etc.
- It seems like I should deal with “minimum” defining properties, but I’m not sure.

You must think about…

- what you will require in descriptions or sortings.
- For example, do I provide a classification and just ask which objects fit or do I ask them to come up with objects to fit classifications?
- Do I tell them what I want in a description or see what they do without being told?

More to think about

- Do I focus on cross-classifications, e.g. an object with A and B, or single classifications?
- Do I ask for others **without** particular characterstics? (i.e. non-examples)

More to think about

- Do I focus on generalizations, e.g. how are all prisms different from all pyramids or focus on specific ones?

Assessment tasks/questions can look pretty different

- Compare :
- How many planes of symmetry does this object have?
- TO
- An object has 6 planes of symmetry. What could it look like?

They can look pretty different

- OR
- Why do cylinders have more planes of symmetry than prisms do?

They can look pretty different

- OR
- How do the number of planes of symmetry differ for a right pyramid and a right prism with the same base?

Should I make different decisions about what is needed for different students?

- Do “struggling” students get more skill focus or do they get more concept focus?

So let's go back to equity

- Equity requires providing the best possible instruction for each and every student.
- Do I think that what we've talked about is enough?

No

- I think we have to start with the kind of thinking I've been describing and then, from there, layering in
- Differentiation
- Appropriate feedback
- Opportunities for engagement, communication, interaction, appropriate challenge, etc.

But

- My worry is that focusing on what should be taught is not playing in enough.
- My worry is that teachers think the curriculum makes it very clear where the focus is.

I think

- There are lots of appropriate "takes" on what I've been talking about.
- BUT the process of reflection on the curriculum is critical for high-level instruction for ALL of our students.
- And they deserve it!