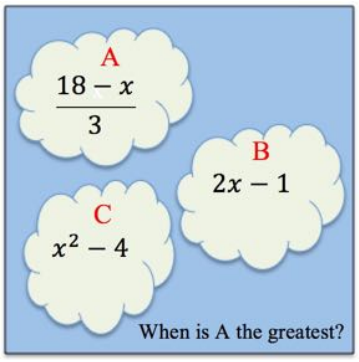
ALMOST TOTAL INEQUALITY



When x is zero, A is greater than both B and C

For what other values of x is A the greatest?

For what values of x is B the greatest ?

For what values of x is C the greatest?

Is there a value of x when neither A nor B nor C is greater than the other two?

You may like to find the answers either algebraically or graphically.

HELP

Sketch a graph – don't bother with it's equation – just say that some algebraic expression involving x and y is ZERO on the graph. For example, $x + y - 3$ is zero on the line $x + y = 3$.

Then ask yourself what happens to the value of the expression which is zero on the graph if you move up from the graph?

What happens to the value of the expression if you move to the right of the graph?

What happens if you move down below the graph?

What happens if you move to the left?

NEXT

Quadratic Matching 1 https://aiminghigh.aimssec.ac.za/quadratic-matching-1/

NOTES FOR TEACHERS

SOLUTION

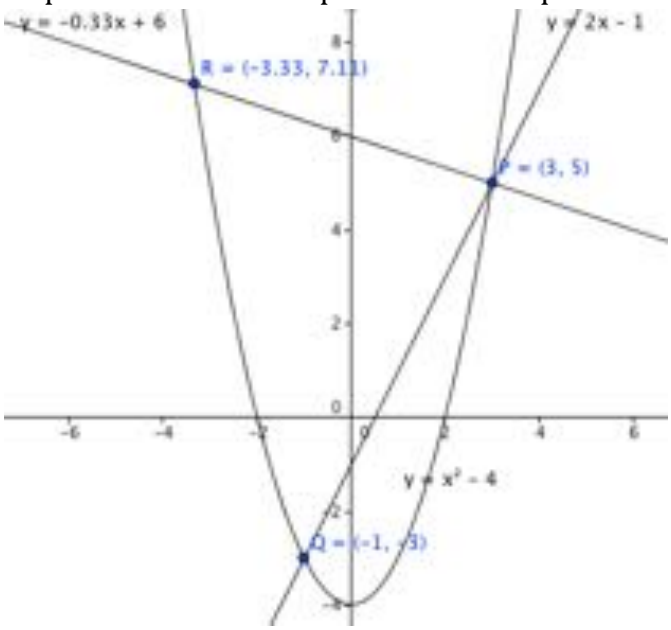
From the graph:

A $\frac{18-x}{3} = -\frac{x}{3} + 6$ is the greatest between R and P

B $2x - 1$ is never the greatest

C $x^2 - 4$ is greatest to the left of R and to the right of P.

At point P the three expressions are equal so neither A nor B nor C is greater than the other two.



Algebraically:
A = B when $(18 - x)/3 = 2x - 1$.

Solving this equation gives x=3 and the expressions have the value y=5.

B = C when
$x^2 - 4 = 2x - 1$ that is $x^2 - 2x - 3 = 0$ and solving this equation gives x = 3 or x = -1. Hence A = B = C at P(3 , 5)

and B = C at Q(-1 , -3).

-10/3 is rounded to 2 decimal places in the diagram.

A = C when $(x^2 - 4) = (18 - x)/3$ which simplifies to the quadratic equation
$3x^2 + x - 30 = 0$

This equation has solutions x = 3 and x = 10/3. So the graphs of A and C intersect at R (-10/3, 64/9).

A is greater than B and C for $-10/3 < x < 3$

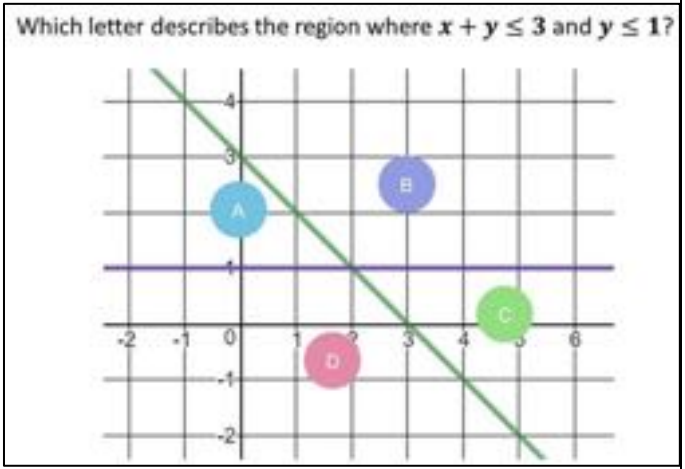
B is greater than C (but less than A) for $-1 < x < 3$ C is greater than A and B for $x < -10/3$ and $x > 3$.

DIAGNOSTIC ASSESSMENT

This should take about 5–10 minutes.

Write the question on the board, say to the class:

"Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D".



1. Notice how the learners respond. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
2. It is important for learners to explain the reason for their answer to improve their communication skills and clear thinking.
3. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.
5. The concept is needed for the lesson to follow, so explain the right answer or give a remedial task.

The correct answer is D :

A. In this region $x + y \leq 3$ and $y \geq 1$

B. In this region $x + y \geq 3$ and $y \geq 1$

The student has chosen the wrong side of both lines to represent the inequalities given.

C. In this region $x + y \geq 3$ and $y \leq 1$

https://diagnosticquestions.com

Why do this activity?

The learning activity is non-routine, and it involves complex procedures and problem solving, so it will help learners to develop higher order cognitive skills.

Learning objectives

In doing this activity students will have an opportunity to:

- draw graphs of linear and quadratic functions;
- to solve linear and quadratic equations to find the intersections of graphs;
- to practice relating inequalities expressed in algebraic terms to regions of a graph.

Generic competences

We need to prepare children for a job market where existing knowledge and skills have limited value unless they can be applied in novel ways to produce new knowledge that solves today's complex problems to improve the quality of life for all.

In doing this activity students will have an opportunity to:

- think mathematically and to reason logically;
- apply knowledge and skills;

- organise, analyse, and interpret information to solve a problem;
- develop the skill of creating and interpreting visual images;
- communicate in writing and speaking:
    - communicate, exchange ideas, criticise, and present information and ideas to others
    - analyze, reason and record ideas effectively;
- work co-operatively and collaborate/work in a team
    - have empathy with others, listen to different points of view
    - practise leadership.

Suggestions for teaching

Start with the Diagnostic Quiz to remind students about the way that regions in a graph can represent linear and quadratic inequalities. Give another example where one graph is linear and the other one quadratic.

Encourage the learners who gave the wrong answers by telling them about the latest research on the brain that has proved that we learn best when we make mistakes and have to struggle to understand a new or difficult idea. Research has shown that when we make mistakes our brain grows new connections or neural pathways and produces a chemical myelin which coats the neural pathways involved and optimises the particular circuits making our thoughts more efficient in the future.

Although this problem is quite challenging, give your learners the opportunity to decide for themselves how to tackle it. Tell your class that when we do work that is quite easy for us, and get lots of correct answers, we don't develop our brainpower nearly as much as when we struggle with a problem, refuse to give up, and finally solve it.

Encourage learners to share their ideas. You might use the one-two-four- more strategy:

1 - work individually,

2 - compare results then work with a partner,

4 - later compare results and work with another pair as a group of four,

more - later share ideas in a whole class discussion.

To understand the concepts fully learners should be encouraged to reflect on both graphical and algebraic methods. You could ask learners who have used one method to present their method to the class, then do the same with the other method.

Make it a general pattern that, lesson by lesson, you give all learners the opportunity to make presentations to the class on behalf of their group. With this teaching strategy you give everyone equal opportunity to develop communication skills and you show that you believe that all learners are capable of succeeding. This gives each small group the

responsibility of making sure that all members of the group understand the work.

It is very important to create a mutually supporting atmosphere in your class where learners listen to each other, and expect to learn from each other, and where nobody feels bad about making mistakes. Everyone in the class should appreciate that they are there to work on the new ideas together so that if a learner giving an explanation to the class gets stuck or makes a mistake then others try to help.

Key questions

- Just think about two of the expressions. How could you find out when one is greater than the other?
- Now you have found an inequality involving two of the expressions how are you going to compare them with the third expression.
- What shape would the graphs be for these expressions?

Follow up

Quadratic Matching 1
https://aiminghigh.aimssec.ac.za/quadratic-matching-1/

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and school years up to Secondary 5 in East Africa.
New material will be added for Secondary 6.
For resources for teaching A level mathematics (Years 12 and 13) see https://nrich.maths.org/12339
Mathematics taught in Year 13 (UK) & Secondary 6 (East Africa) is beyond the SA CAPS curriculum for Grade 12

	Lower Primary Approx. Age 5 to 8	Upper Primary Age 8 to 11	Lower Secondary Age 11 to 15	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13