Today's topics and news

- Topic: Related rates, inverses
- **Reading week** is next week. Have a nice break!
- **Homework:** Watch videos 4.3 - 4.8 for Tuesday and 5.1 - 5.4 for Wednesday.

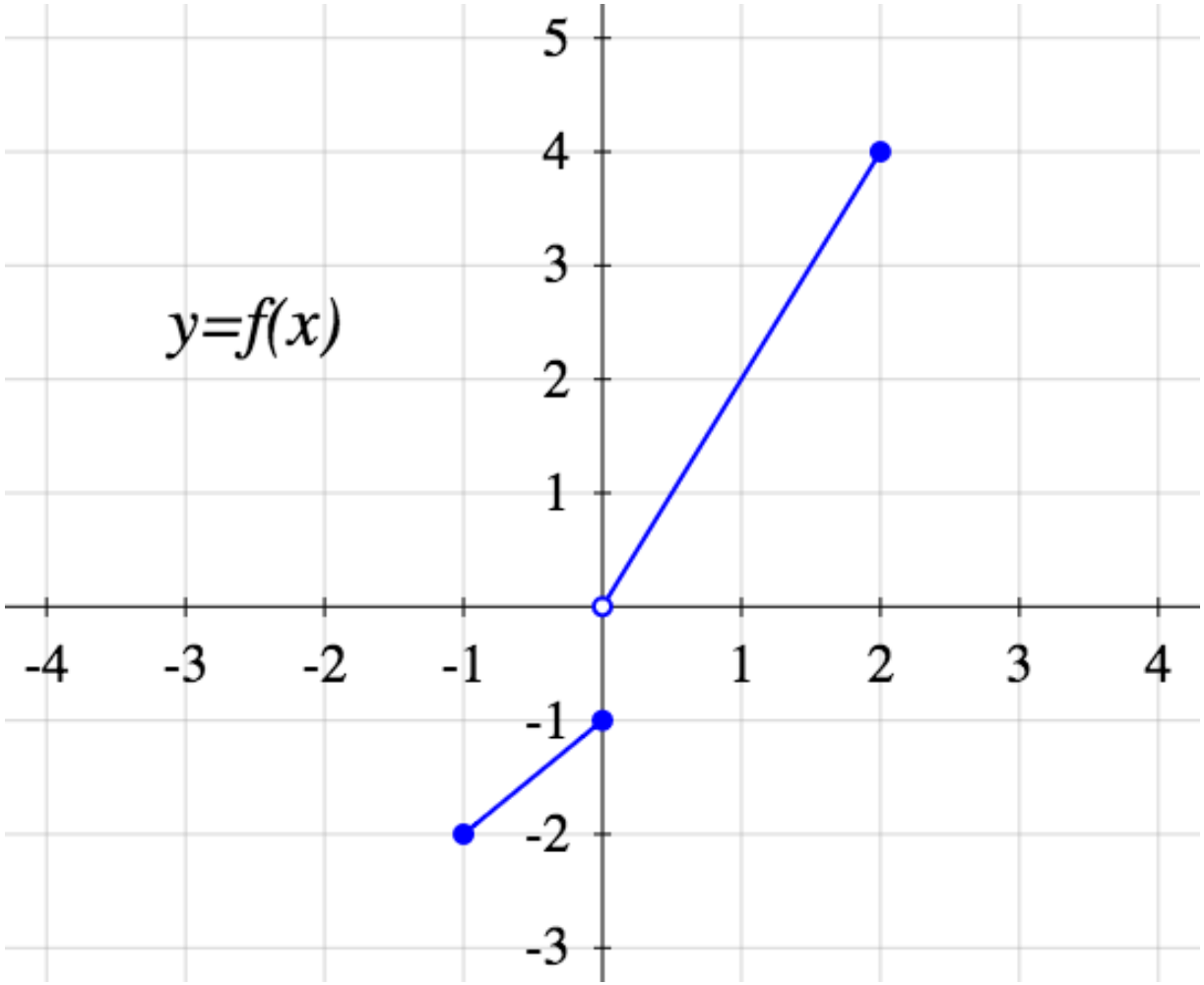
Math Halloween party

The MAT137 TAs wanted to rent a disco ball for their upcoming Halloween party. However, since they are poor, they can only afford a flashlight. At the party, one TA is designated the "human disco ball". This TA stands in the centre of the room pointing the flashlight horizontally and spins at 3 revolutions per second. (YES, they are THAT fast.) The room is square with side length 8 meters. At what speed is the light from the flashlight moving across the wall when it is 2 meters away from a corner?

Related rates

A 10-meter long ladder is leaning against a vertical wall and sliding. The top end of the ladder is 8 meters high and sliding down at a rate of 1 meter per second. At what rate is the bottom end sliding away from the wall?

Inverse function from a graph



Calculate:

1. $f(2)$
2. $f(0)$
3. $f^{-1}(2)$
4. $f^{-1}(0)$
5. $f^{-1}(-1)$

Absolute value and inverses

Let

$$h(x) = x|x| + 1$$

1. Calculate $h^{-1}(-8)$.
2. Find an equation for $h^{-1}(x)$.
3. Sketch the graphs of h and h^{-1}.
4. Verify that for every $x \in \mathbb{R}$ = range of h = domain of h^{-1}, $h(h^{-1}(x)) = x$, and that
   for every $x\mathbb{R}$ = domain of h = range of h^{-1},
   $h^{-1}(h(x)) = x$.

An interesting example

Let $f(x) = x^2 \sin \frac{1}{x}$ if $x \neq 0$ and 0 if $x = 0$.

1. Calculate $f'(x)$ for any $x \neq 0$.
2. Using the definition of derivative, calculate $f'(0)$.
3. Is f continuous at 0?
4. Is f differentiable at 0?
5. Is f' continuous at 0?