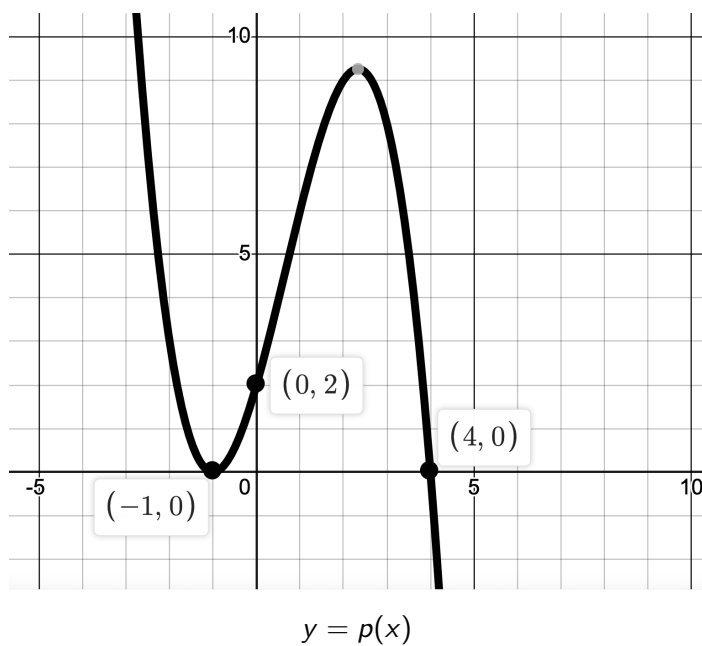


**MATH 1650: TEST 02 (100 points.)**

**NAME:** \_\_\_\_\_

**DIRECTIONS:** To receive full credit, make sure your work is neat and complete.

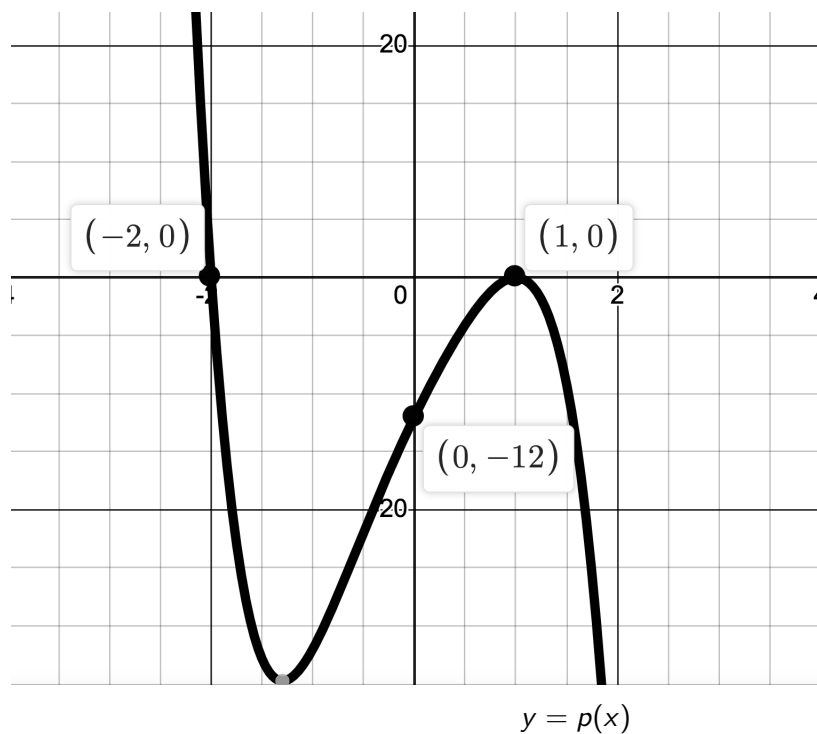
1. The complete graph of the polynomial function  $y = p(x)$  is below.



Find a possible formula for  $p(x)$ . Explain your reasoning!

2. Let  $p(x) = -2x^5 - 4x^2 + 18x - 12$ .

(a) Use the graph of  $y = p(x)$  and synthetic division to find the **exact** values of all the **real zeros** of  $p$ .



(b) Factor  $p(x)$  over the **real numbers**.

(c) Find the **nonreal** zeros of  $p$  and factor  $p(x)$  over the **complex numbers**.

(d) Make a **Sign Diagram** for  $p(x)$ .

(e) Use your Sign Diagram to help you solve:

i.  $18x - 12 < 2x^5 + 4x^2$

ii.  $18x - 12 \leq 2x^5 + 4x^2$

3. Let  $r(x) = \frac{3x^3 - 6x}{x^2 - 2x}$ .

(a) Algebraically find the values excluded from the domain of  $r$  and explain why they are excluded.

(b) Reduce  $r(x)$  to lowest terms.

(c) i. Algebraically find the  $x$ -intercept(s) of the graph of  $y = r(x)$ .

ii. Explain why there is no  $y$ -intercept.

(d) Algebraically find the vertical asymptote and hole in the graph of  $y = r(x)$ .

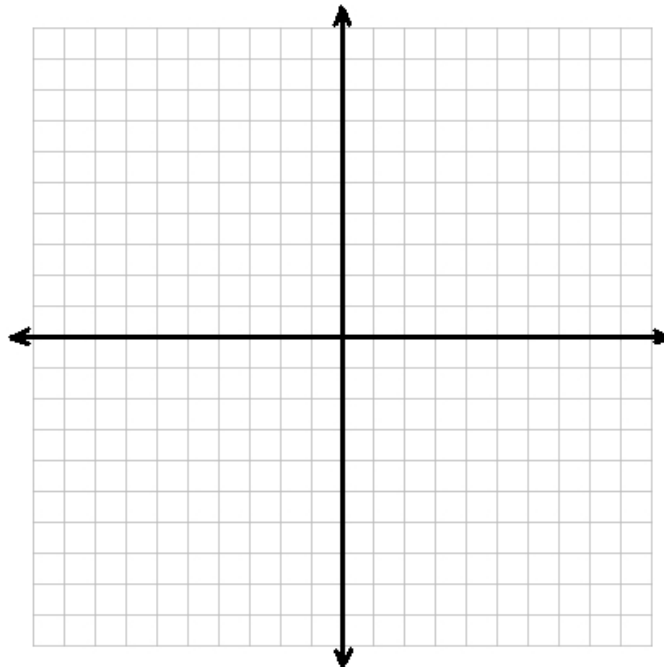
vertical asymptote:

hole:

(e) Explain how you know the graph of  $y = r(x)$  has a slant asymptote and find it.

(f) Make a Sign Diagram for  $r$ .

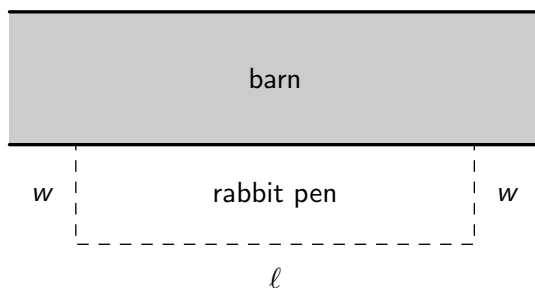
(g) Sketch an incredibly detailed graph of  $y = r(x)$  on the axes provided.



4. Use a Sign Diagram to help you find the domain of  $f(x) = \sqrt{\frac{2-x}{3x+5}}$ .

5. Use a Sign Diagram to help you solve:  $(x+3)^{-\frac{2}{5}} \geq (x+3)^{\frac{3}{5}}$

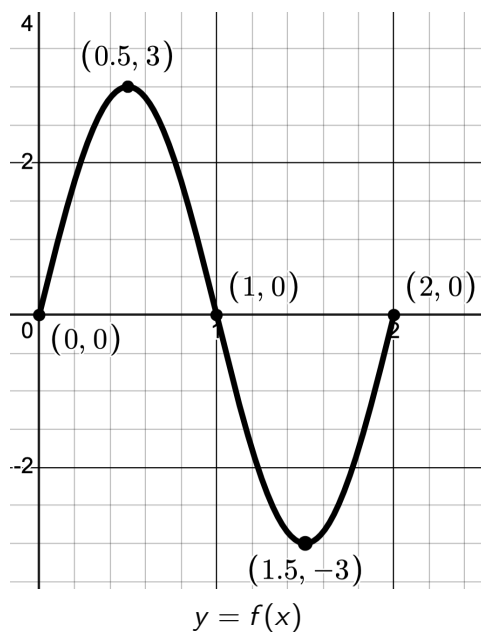
6. Taylor needs to design a 200 square foot rectangular pen along the side of her barn for her pet vorpal rabbit. Since the pen will be against the barn, she has no need to fence along that side of the pen.



- (a) Find a formula for the amount of fencing required  $F$  in terms of  $w$  and  $\ell$ .
- (b) Use the fact that the area of the pen is to be 200 square feet to help you find a formula for the amount of fencing required  $F$  as a function of just the width,  $w$ .
- (c) Use desmos to graph  $F$  to determine the minimum amount of fencing needed and the dimensions of the pen to achieve that minimum.
- (d) **BONUS:** What would be an appropriate 'mathy' name for the rabbit?

**BONUS:** Use the complete graph of  $y = f(x)$  to answer the following questions.

Write your answers using interval notation.



1. Make a Sign Diagram for  $f$ . **HINT:** The domain of  $f$  is just what you see here:  $[0, 2]$ .

2. What is the domain of  $g(x) = \sqrt{f(x)}$ ? Explain your reasoning.

3. What is the domain of  $g(x) = \sqrt[3]{f(x)}$ ? Explain your reasoning.

4. What is the domain of  $g(x) = \frac{f(x)}{x-1}$ ? Explain your reasoning.

5. What is the domain of  $g(x) = \frac{x-1}{f(x)}$ ? Explain your reasoning.