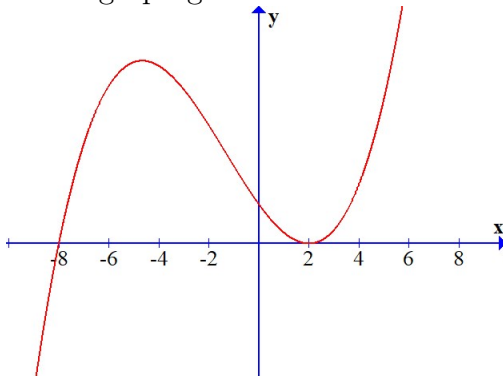


You are allowed three pages of notes and a calculator. No phones and your bag etc. ought to be on the floor out of sight. There at least 200pts to earn here. Thanks!

**Problem 1:** (10pt) Find the standard form of the polynomial  $f(x) = (x^2 - 2)(x^3 + x - 7)$ .

**Problem 2:** (10pts) Find  $P(x)$  which could have a graph which shares the same shape and  $x$ -intercepts as the graph given below:



**Problem 3:** (5pt) Assume  $x, y > 0$  and use laws of algebra to determine  $A, B$  as indicated below:

$$x^A y^B = \sqrt{\frac{y^{-3}(xy)^4}{x^{-2}y^3}}$$

**Problem 4:** (20pts) Consider the graph  $y = f(x)$  given below. Answer the following questions using interval notation where appropriate. Fill in the blanks:

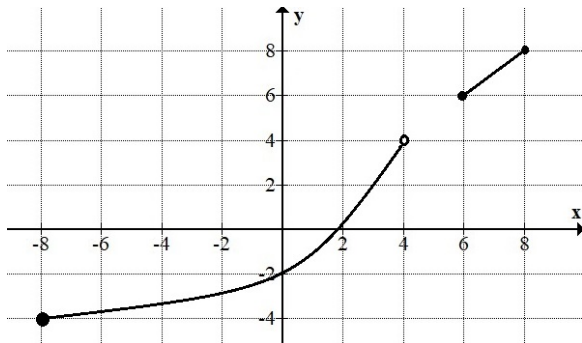
(a.) the domain of  $f(x) =$  \_\_\_\_\_.

(b.) the range of  $f(x) =$  \_\_\_\_\_.

(c.)  $f(4) =$  \_\_\_\_\_.

(d.)  $f(6) =$  \_\_\_\_\_.

(e.) If  $g(x) = 5x - 18$  the calculate  $(f \circ g)(2) =$  \_\_\_\_\_.



**Problem 5:** (10pts) Let  $f(x) = \begin{cases} 2x + 7 & : -10 < x < 0 \\ 3 + \sqrt{x} & : 0 \leq x \leq 10 \end{cases}$ .

Given the function above, calculate:

(a.)  $f(-3) =$  \_\_\_\_\_.

(b.)  $f(4) =$  \_\_\_\_\_.

**Problem 6:** (10pts) Find the equation of a line given that contains points  $(-1, -5)$  and  $(2, 1)$ .

**Problem 7:** (5pts) Solve  $3 - 2x > 7$  and give the answer in interval notation.

**Problem 8:** (10pts) Solve  $|3 + x| - 5 > 10$  and give the answer in interval notation ( you might need to use  $\cup$  for union ).

**Problem 9:** (10pts) Solve the following inequality using an appropriate technique. **Show your work** and write the answer using interval notation ( you might need to use  $\cup$  for union )

$$\frac{(x + 6)^3(x^2 - 4)}{x(x - 3)^5} \geq 0$$

**Problem 10:** (15pt) **Factor** each  $f(x)$  given below completely over  $\mathbb{R}$ .

(a.)  $9x^4 - x^2$ ,

(b.)  $x^2 - 11x + 24$ ,

(c.)  $x^4 + x^2 - 6$ .

**Problem 11:** (5pts) Find all real solutions of  $9x^4 - x^2 = 0$ .

**Problem 12:** (10pt) For each quadratic polynomial  $f(x)$  given below, complete the square and find all real or complex solutions of  $f(x) = 0$ :

(a.)  $f(x) = x^2 + 8x + 25$ ,

(b.)  $f(x) = 2x^2 + 6x + 4$ .

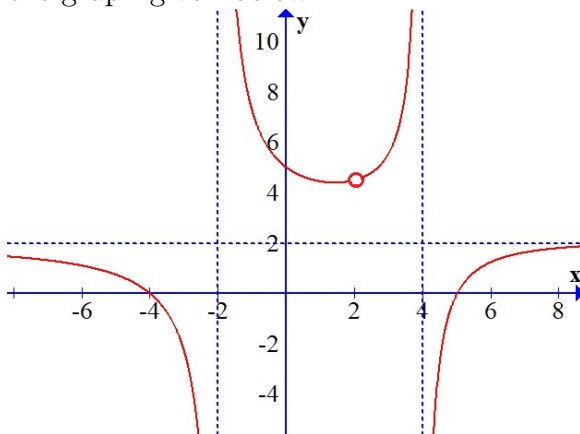
**Problem 13:** (10pt) Where is the vertex for the parabola  $y = f(x)$  given that:

(a.)  $f(x) = x^2 + 8x + 25$ ,

(b.)  $f(x) = 3(x - 4)(x - 8)$ .

**Problem 14:** (10pt) Solve  $\sqrt{x+6} = x$ .

**Problem 15:** (10pts) Find a rational function  $f(x)$  which could have a graph which shares the same shape as well as matching horizontal and vertical asymptotes **and zeros and hole** as the graph given below:

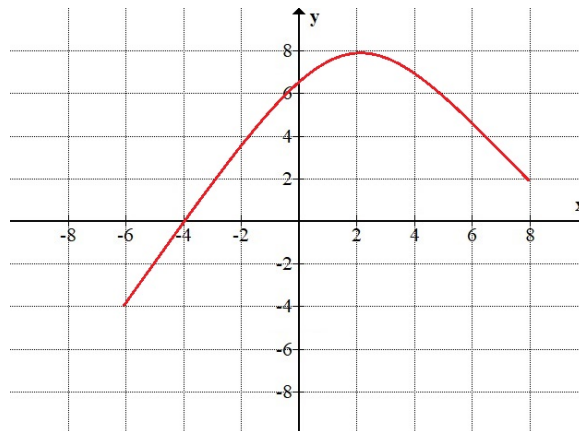
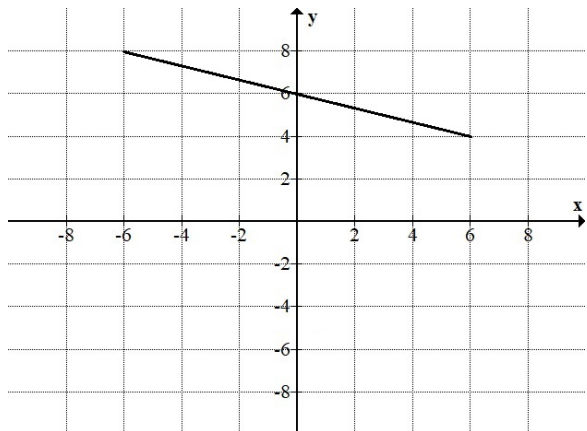


**Problem 16:** (10pts) Let  $f(x) = (2x + 3)^2$  and  $g(x) = \frac{4}{x}$ . Find the formulas for:

(a.)  $(f \circ g)(x) =$

(b.)  $(g \circ f)(x) =$

**Problem 17:** (10pts) If possible, graph the inverse function for each function graph below. If the function does not have an inverse explain why.



**Problem 18:** (10pts) Given the function  $f(x) = \frac{2x - 3}{x + 8}$  calculate the formula for  $f^{-1}(y)$ .

**Problem 19:** (10pts) Suppose a polynomial  $P(x)$  has a graph which crosses the  $x$ -axis at  $x = -1$  and bounces off the  $x$ -axis at  $x = 3$ . Find formula of  $P(x)$  given that the  $y$ -intercept is 90.

**Problem 20:** (10pts) Factor  $f(x) = x^3 - 8x^2 + 9x + 18$  completely over  $\mathbb{R}$ . Hint:  $f(3) = 0$ .

**Problem 21:** (10pts) Factor  $f(x) = x^6 - 4x^5 + 5x^4 - 16x^2 + 64x - 80$  completely over  $\mathbb{R}$ .  
Hint:  $f(2 + i) = 0$ .