

There are 8 problems on this exam. Carefully read and follow all directions. In order to receive credit show all necessary work. No credit will be given for an answer I cannot find or cannot read.

1. Consider the quadratic function  $f(x) = 2x^2 + 20x - 22$ . Complete the following statements. (2 points per blank)

The graph of  $y = f(x)$  is a parabola that opens \_\_\_\_\_ and has the point  
up/down

(\_\_\_\_\_, \_\_\_\_\_) as its vertex. This vertex is a \_\_\_\_\_.  
maximum/minimum

The x-intercept(s) on the graph of  $y = f(x)$  is/are located at  $x =$  \_\_\_\_\_.

The y-intercept on the graph of  $y = f(x)$  is located at  $(0, \text{_____})$ .

The axis of symmetry for this parabola is \_\_\_\_\_. The domain of the

function  $f(x)$  is \_\_\_\_\_ and the range of the function  $f(x)$  is \_\_\_\_\_.

2. Write the function  $f(x)$  from problem 1 in shifted form and describe in terms of shifts and/or reflections how the graph of  $y = f(x)$  can be obtained from the graph of  $y = 2x^2$ . (6 points)

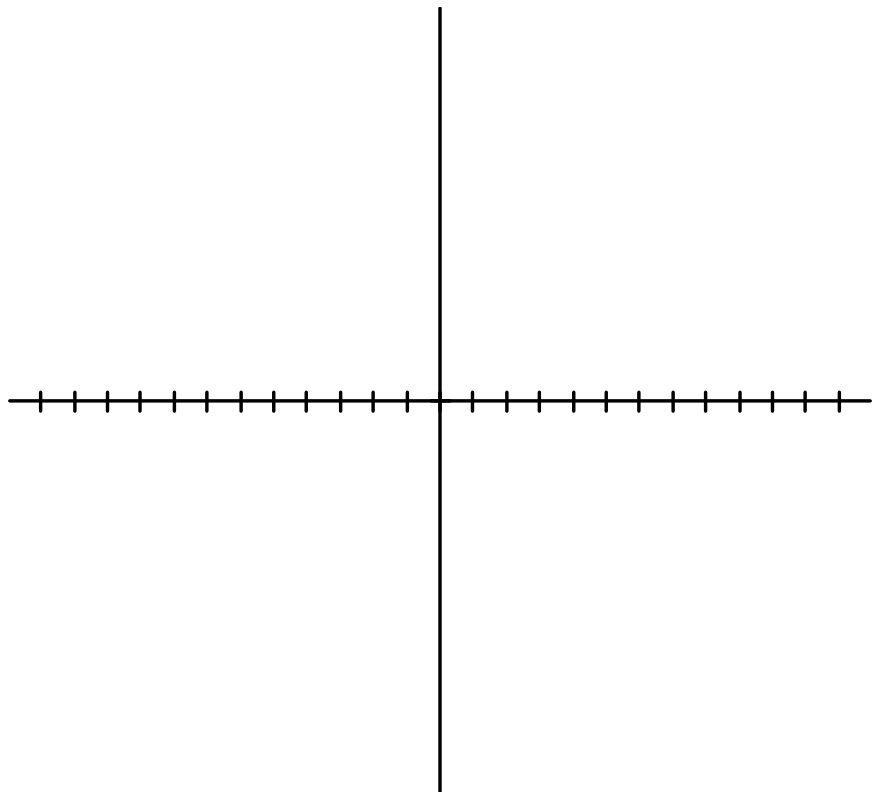
3. Let  $g(x) = (2x - 1)^2(x + 4)^3(8 - 2x)$ .

(a) What is the degree of  $g(x)$ ? (2 points)

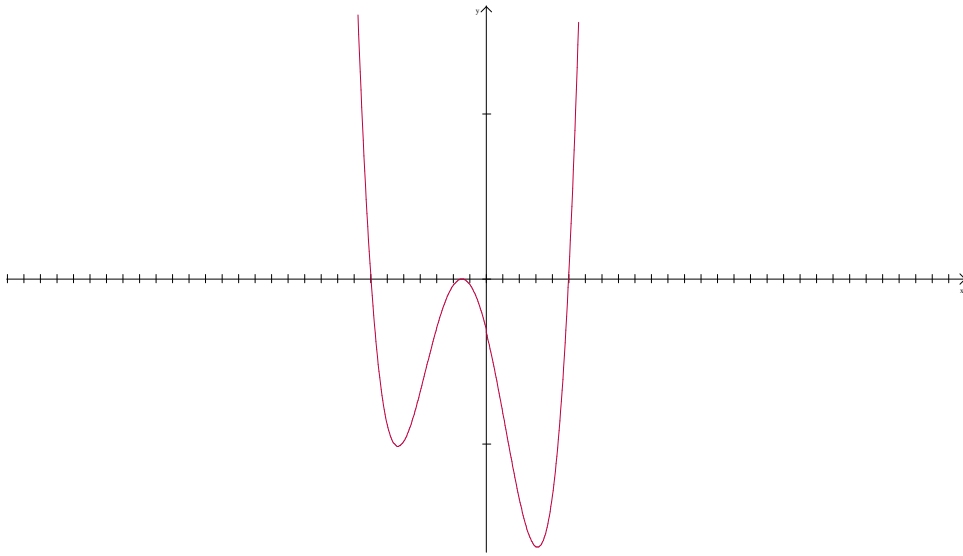
(b) What is the leading term of  $g(x)$ ? (2 points)

(c) What is the  $y$ -intercept on the graph of  $y = g(x)$ ? (2 points)

(d) Sketch the graph of  $y = g(x)$ . Be sure to accurately graph all  $x$  intercepts. (5 points)



4. Determine a polynomial in factored form whose graph would look like the graph shown below. (5 points)



5. Given that  $3i$  is a zero of the polynomial  $x^4 - 10x^3 + 38x^2 - 90x + 261$  determine all zeros of this polynomial. (8 points)

6. Let  $h(x) = 2x^5 - 19x^4 + 66x^3 - 90x^2 + 16x + 40$ .

(a) According to Descartes' rule of signs how many positive real zeros can  $h(x)$  have? (3 points)

(b) Determine  $h(-x)$ . (3 points)

(c) According to Descartes' rule of signs how many negative real zeros can  $h(x)$  have? (3 points)

(d) List the possible rational zeros of this polynomial. (4 points)

(e) In an appropriate window graph  $h(x)$  and determine three rational zeros of  $h(x)$  counting multiplicities. (3 points)

(f) Use synthetic division to "divide out" the three rational zeros found in part (e). (6 pts)

(g) Determine the other two zeros of this polynomial. (6 points)

(i) Determine the complete factorization of this polynomial. (5 points)

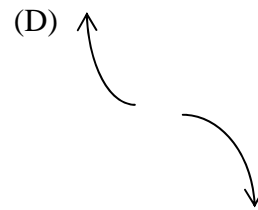
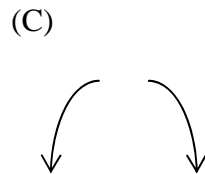
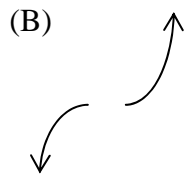
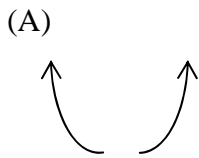
7. Let  $F(x) = x^3 - 6x - 4$ .

(a)  $F$  has one rational zero. Determine this zero. (3 points)

(b) Use synthetic division to “divide out” the zero from part (a). (4 points)

(c) Determine the other two zeros of this polynomial. (6 points)

8. Indicate by letter which of the following is the left/right behavior of the specified polynomial function. (2 points each)



\_\_\_\_\_ A polynomial whose leading term is  $-5x^{10}$

\_\_\_\_\_ A polynomial whose leading term is  $6x^5$

\_\_\_\_\_ The polynomial  $(2x + 1)^3(x - 5)^2(x + 15)^3$