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# MATH 11010: Exam #3 (Fall 2012)

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1. Determine if the following function is an even, odd, or neither function.

(a)  $f(x) = -3x^3 + 7x - 9$

(b)  $f(x) = 2x^4 + 6x^2 - 3$

2. Find the equation of the horizontal asymptote of the following functions, if one exists. Be specific!

(a)  $f(x) = \frac{5x^2 - 20}{4x^3 - 12x^2 - 16x}$

(b)  $g(x) = \frac{35x^2 + 2x - 1}{12x^2 + x - 6}$

3. Find the equation of the vertical asymptote(s) of the following functions. Be specific!

(a)  $f(x) = \frac{5x^2 - 20}{4x^3 - 12x^2 - 16x}$

(b)  $g(x) = \frac{35x^2 + 2x - 1}{12x^2 + x - 6}$

4. Find a rational function that satisfies the following conditions:

Vertical Asymptotes:  $x = \frac{4}{5}, x = -\frac{2}{3}$

Horizontal Asymptote:  $y = \frac{7}{30}$

5. Find a polynomial function with zeros  $x = -\frac{1}{5}$  (multiplicity 2),  $x = 0$  (multiplicity 3), and  $x = 4$  (multiplicity 1). You may leave your answer in factored form.

6. Use the Rational Zero Theorem to list all possible rational zeros of

$$f(x) = 7x^4 - 8x^3 + 5x^2 - 3x + 6.$$

7. Use synthetic division to divide

$$P(x) = 2x^5 + 3x^4 + 25x^2 - 8x - 10 \quad \text{by} \quad x + 3.$$

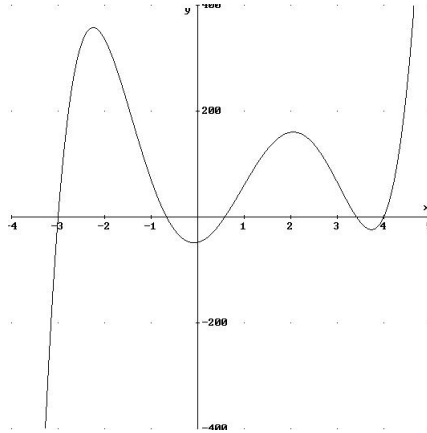
Identify the quotient and remainder. Be specific.

8. Suppose a polynomial function with rational coefficients has

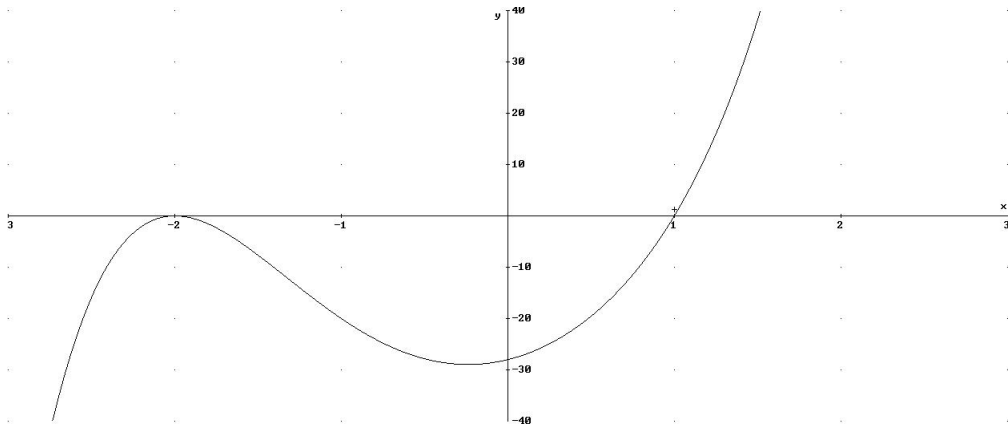
$$\frac{8}{5}, \quad 3 + 7i, \quad -4, \quad \text{and} \quad 6 - 2\sqrt{5}$$

as some of its zeros. List the values that must also be zeros.

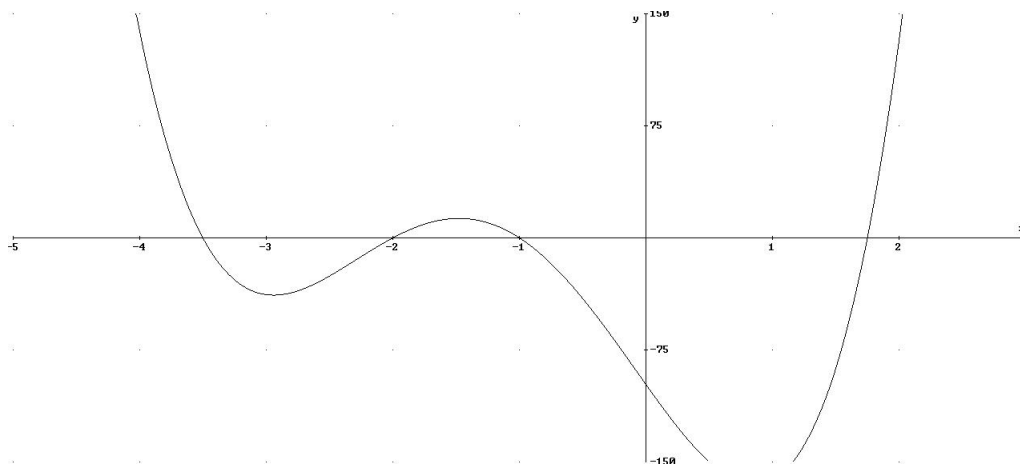
9. Consider  $P(x) = 3x^5 - 13x^4 - 28x^3 + 126x^2 + 20x - 48$  whose graph is given below.



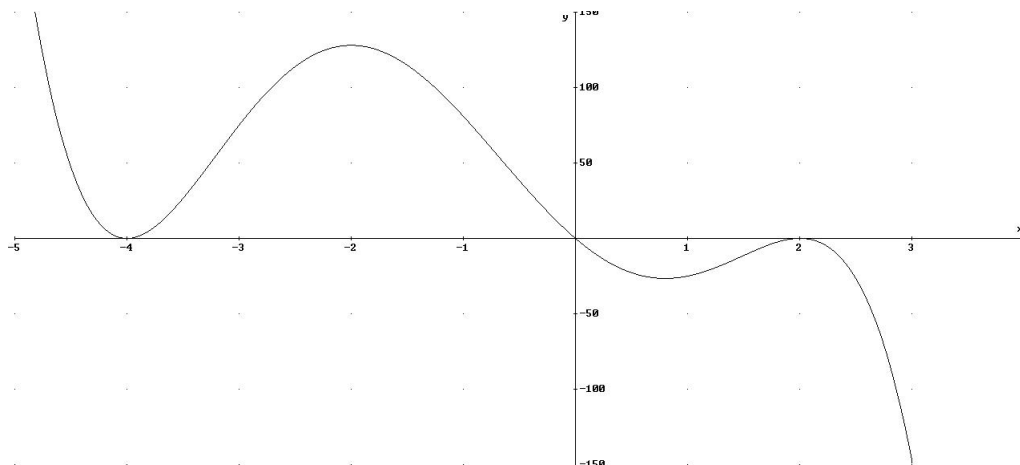
- (a) Show that  $x = -\frac{2}{3}$  is a zero.
- (b) Find all other zeros of  $P$ . You must show all work. (Show algebraically that they are zeros).
10. Consider  $P(x) = x^5 + x^4 + x^3 + 17x^2 + 8x - 28$  whose graph is given below. Find all zeros of this function. (Show algebraically that they are zeros).



11. Find all zeros of  $P(x) = 8x^4 + 38x^3 + 9x^2 - 119x - 98$ .



12. Given below is the graph of  $f$ .



- Is the degree of  $f$  even or odd?
- Is the leading coefficient of  $f$  positive or negative?
- Determine the interval(s) where  $f(x) > 0$ .
- Determine the interval(s) where  $f(x) < 0$ .
- List the real zeros of  $f$  AND state whether each zero has even or odd multiplicity.

13. Solve:  $6x^2 - 5x - 4 \geq 0$

14. Solve:  $\frac{3x^2}{2x^2 + x - 21} \geq 0$

**ANSWERS**

1. (a) neither
- 
- (b) even

2. (a)
- $y = 0$
- 
- (b)
- $y = \frac{35}{12}$

3. (a)
- $x = 0, x = 4, x = -1$
- 
- (b)
- $x = -\frac{3}{4}, x = \frac{2}{3}$

4.  $\frac{7x^2}{30x^2 - 4x - 16}$

5.  $P(x) = x^3(5x + 1)^2(x - 4)$

6.  $\pm 1, \pm 2, \pm 3, \pm 6, \pm \frac{1}{7}, \pm \frac{2}{7}, \pm \frac{3}{7}, \pm \frac{6}{7}$

7.  $R(x) = -4, Q(x) = 2x^4 - 3x^3 + 9x^2 - 2x - 2$

8.  $3 - 7i, 6 + 2\sqrt{5}$

9. (a) use synthetic division to show that the remainder is 0.
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- (b)
- $x = -3, x = 4, x = 2 \pm \sqrt{2}$

10.  $x = -2$  (mult 2),  $x = 1, x = 1 \pm \sqrt{6}i$

11.  $x = -1, x = -2, x = \frac{7}{4}, x = -\frac{7}{2}$

12. (a) odd
- 
- (b) negative
- 
- (c)
- $(-\infty, -4) \cup (-4, 0)$
- 
- (d)
- $(0, 2) \cup (2, \infty)$
- 
- (e)
- $-4$
- even,
- $0$
- odd,
- $2$
- even

13.  $\left(-\infty, -\frac{1}{2}\right] \cup \left[\frac{4}{3}, \infty\right)$

14.  $\left(-\infty, -\frac{7}{2}\right) \cup (3, \infty)$