EXAM 3 - MATH 111   Thursday, November 9
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Read each problem **very carefully** before starting to solve it. Each problem is worth 10
points. It is necessary to show **all** your work. Correct answers without explanations are
worth 0 points. GOOD LUCK!!

1. (a) Perform the long division $(x^5 + 3x^4 - 5x^2) \div (x^3 + 2)$ and write your answer in an
       appropriate form.

   (b) Suppose we know that $x = 5$ is a zero of $P(x) = 6x^3 - 29x^2 - 7x + 10$. Use the factor
       theorem to find all factors and the remaining zeros of $P(x)$.

2. Consider the function

$$f(x) = \frac{(x+1)^2}{(x+3)(x-2)}.$$

(a) Find its domain.
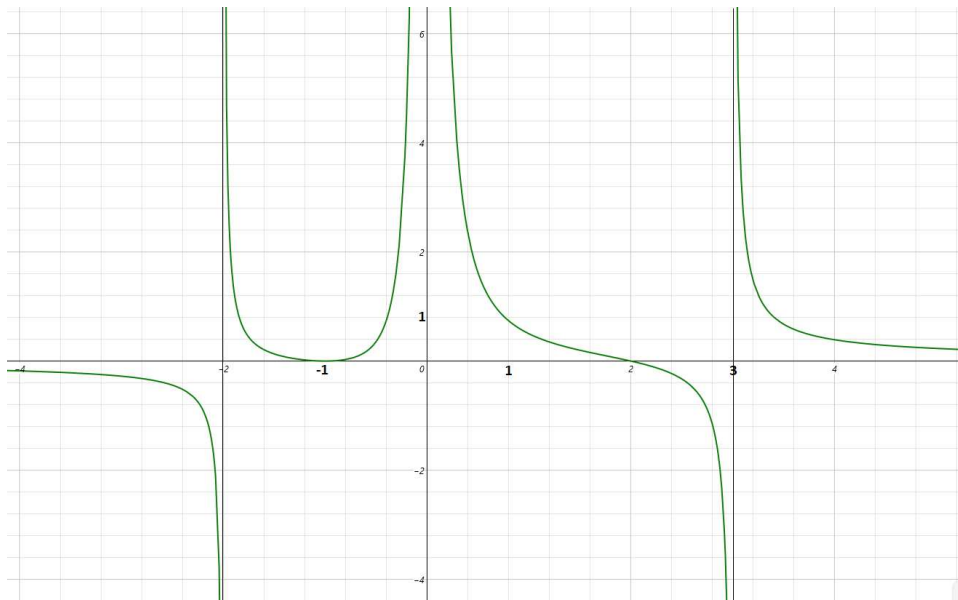
(b) Find its vertical asymptote(s).

(c) Find its horizontal asymptote.

(d) Find its y-intercept.

(e) Find its x-intercept(s).

(f) Sketch the graph showing all important features.

3. Suppose the following is the graph of $y = f(x)$.

(a) Find its domain.

(b) Find its vertical asymptote(s).

(c) Find its horizontal asymptote.

(d) Find its y-intercept.

(e) Find its x-intercept(s).

(f) Find a possible formula for $y = f(x)$.

4. A classmate of yours, who is majoring in Ecology is studying a certain environment in which there are:

- A number x of individuals of a species of primary interest;
- A number y of nutrients;
- A number z of predators.

She found that x is varying directly with the square of y and inversely with the cube root of z. Moreover, when $y = 4$ and $z = 125$, then $x = 32$. If her measurements showed that the population of her primary species was 500 when the estimated number of nutrients was 10, what was the estimated number of predators present?

5. (a) Find a formula for an exponential function passing trough the points $(0,7)$ and $(3,189)$ explaining all steps.

(b) The following shows the graph of a transform $y = f(x)$ of the basic exponential function $y = (\frac{9}{10})^x$. Find a formula for $y = f(x)$ explaining all steps.