

PreCalculus

Midterm Review—Units 1, 2, 3

1. For the following function: $f(x) = -2x^3 + 16x^2 - 74x + 100$
 - a) Name the function by degree and number of terms
 - b) Give the end behavior of the function in limit form
 - c) How many complex roots does the function have?
 - d) How many real roots does the function have?
 - e) How many imaginary roots does the function have?
 - f) According to Descartes, how many positive real roots could the function have?
 - g) According to Descartes, how many negative real roots could the function have?
 - h) Find the least integer upper bound of the function
 - i) Find the greater integer lower bound of the function
 - j) List all possible rational roots of this function according to the Rational Root Thm
 - k) Use the Remainder Theorem to show that -3 is *not* a root to this function
 - l) Use Synthetic Division to show that 4 is *not* a root to this function
 - m) Give the y-intercept(s) of this function
 - n) Give the x-intercept(s) of this function
 - o) Find all complex roots to this function
 - p) Give the linear factorization of this function.
 - q) Give the resulting function if we take $f(x)$ and reflect it across the x-axis.
 - r) Give the resulting function if we take $f(x)$ and reflect it across the y-axis.
 - s) Give the resulting function if we take $f(x)$ and vertically stretch it by a factor of $c = 3$
 - t) Give the resulting function if we take $f(x)$ and horizontally shrink it by a factor of $c = \frac{1}{2}$

2. Simplify: $(-3i^3 + 2i^6)(7i^4 + 6i^5)$

3. Give the polynomial function that has complex roots of: $-1, 2, -2 \pm 3i$, and has a y-intercept of 52.

4. Sketch the following function: $g(x) = -x(x-4)^2(x+2)^3$

5. For each of the following graphs, give the correct order and description of transformations used to create the function $g(x)$ from the parent graph $f(x)$.

a) $f(x) = x^3$ $g(x) = 3(x-3)^3 - 5$

b) $f(x) = e^x$ $g(x) = 4e^{\frac{1}{3}x+1}$

c) $f(x) = \sqrt{x}$ $g(x) = -\frac{1}{4}\sqrt{x-2}$

d) $f(x) = \ln x$ $g(x) = \ln(4-x) + 5$

6. Solve the following equations:

a) $2\log_3 x - 3 = 4$

b) $3^{x+2} = 5^{x-1}$

c) $\ln(x-4) + \ln(x) = 3\ln 2$

d) $\log_4(x-3) = 3$

7. If:
$$g(x) = \begin{cases} -3x+2 & x < -3.5 \\ [x] & -3.5 \leq x < -0.5 \\ x^2 - 4x & -0.5 \leq x < 2.5 \\ |3x - 0.5| & x > 2.5 \end{cases}$$

Evaluate:

a) $g(-4)$ b) $g(-3.5)$ c) $g(-1)$ d) $g(0)$ e) $g(2.5)$ f) $g(4.5)$

8. For the following function: $h(x) = \frac{2x-1}{x+1}$

- Give the equations for *all* asymptotes and locations of any holes
- Give the x-intercept(s)
- Give the y-intercept(s)
- Give the end behavior and asymptote behavior in Limit Form
- How has $h(x)$ been transformed from its parent graph?

9. For the following function: $j(x) = \frac{x^2 - x - 6}{x^2 - 5x - 6}$

- Give the equations for *all* asymptotes and holes
- Give the x-intercept(s)
- Give the y-intercept(s)
- Give the end behavior and asymptote behavior in Limit Form

10. For the following function: $j(x) = \frac{6x-1}{3x^2-14x-5}$
- a) Give the equations for *all* asymptotes and holes
 - b) Give the x-intercept(s)
 - c) Give the y-intercept(s)
 - d) Give the end behavior and asymptote behavior in Limit Form

11. For the following function: $j(x) = \frac{x^4 - 15x^2 + 10x + 24}{x^2 - 4x - 12}$
- a) Give the equations for *all* asymptotes and holes
 - b) Give the x-intercept(s)
 - c) Give the y-intercept(s)
 - d) Give the end behavior and asymptote behavior in Limit Form

12. The population P of deer after t years in Duke Forest is modeled by the function

$$P(t) = \frac{1800}{1 + 29e^{-0.7t}}$$

- a) What is the initial number of deer?
- b) When will there be 1000 deer?
- c) What is the maximum number of deer planned for the park?

13. The number of rabbits in Akron doubles every month. There are 20 rabbits present initially.

- a) Express the number of rabbits as a function of the time t .
- b) How many rabbits were present after 5 years?
- c) When will there be 10,000 rabbits?

14. The half-life of a certain radioactive substance is 65 days. There are 3.5 grams present initially.

- a) Express the amount of substance remaining as a function of time t .
- b) When will there be less than 1 gram remaining?