MAT 170 **EXAM 2 REVIEW**

Zeros of a Polynomial – *Sections 2.3-2.5*

Algebraically solve the following equations:

1. $x^3 - 7x^2 + 11x = 0$
2. $2x^3 + 3x^2 - 89x + 120 = 0$
3. $x^3 - 3x^2 - x + 3 = 0$

Zeros and Multiplicities – *Section 2.3*

Algebraically find all the zeros and their multiplicities for the following functions:

4. $f(x) = 2x^3 - 3x^2 - 12x + 20$
5. $f(x) = x^3 - 3x + 2$
6. $f(x) = 3x^3 + 22x^2 + 15x - 100$

End Behavior of Polynomials – *Section 2.3*

Use the leading coefficient test to determine the end behavior of the following polynomial functions:

7. $f(x) = -2x^3 + x - 2$
8. $f(x) = -x^{10} - 3x^9 + x^2$
9. $f(x) = 2x^3 + x - 2$

Long or Synthetic Division – *Section 2.4*

Divide the following using long or synthetic division:

10. $\dfrac{2x^4 - 6x^2 + 1}{x + 1}$
11. $\dfrac{4x^2 - 8x + 1}{2x - 1}$
12. $\dfrac{2x^3 - 7x^2 + 2x + 3}{x - 3}$

Vertical Asymptotes – *Section 2.6*

Find the equation of the vertical asymptotes (if any) of the following functions:

13. $f(x) = \dfrac{3x + 2}{x^2 - 1}$
14. $f(x) = \dfrac{x + 4}{3x + 1}$
15. $f(x) = \dfrac{x + 2}{x^2 - 4}$

Applications of Rational Functions – *Section 2.6*

16. The following rational function in hundreds models the population of a certain species of animal, where *t* is measured in days. What number does the population approach in the long run?

$$p(t) = \frac{10t^3 + 2}{2t^3 + 1}$$

17. The average cost of producing a popular board game is given by the function: $\overline{C}(x) = \frac{1500 + 15x}{x}$, $x \geq 0$, when *x* is the number of the board game sold, identify the horizontal asymptote of the function and explain its meaning in this context.

18. The function $N(t) = \frac{0.8t + 100}{5t + 4}$, $t \geq 15$, gives the body concentration $N(t)$, in parts per million of a certain dosage of medication after time *t*, in hours. Find the horizontal asymptote of the graph and explain the meaning in the context of the problem.

Rewrite in the equivalent logarithmic form – *Section 3.1*

19. $a^{x+1} = 65$

20. $e^{3x} = 5$

Rewrite in the equivalent exponential form – *Section 3.2*

21. $\log_6(4x) = 10$

22. $\ln(B) = A$

Compound interest – *Section 3.4*

23. Find the accumulated value of an investment of $21,000 at an interest rate of 5.6% for 7 years:
    a) compounded monthly
    b) compounded continuously

24. a) What initial investment at 3.75% interest compounded continuously for 10 years will accumulate to $20,000?Round your answer to the nearest cent.
    b) What initial investment at 4.25% interest compounded monthly for seven years will accumulate to $20,000?Round your answer to the nearest cent.

Properties of Logarithms – *Section 3.3*

Use properties of logarithms to write as a sum or difference logarithms with no exponents.

25. $\log\left(\frac{x^5 y^7}{z^3}\right)$

26. $\ln\left((x-1)^{\frac{3}{2}}\sqrt{\frac{(y+3)^4}{z^8}}\right)$

Use properties of logarithms to express the following as a single logarithms

27. a) $2\ln(x) - 5\ln(y) + 9\ln(w)$
    b) $\frac{3}{2}\ln(x+3) - \ln(x) - \frac{1}{2}\ln(x+3)$

28. a) $3\log(A) - 4\log(B) + 5\log(C) - 6\log(D)$
    b) $\log(8) + \log(x^2 - 1) - \log(x) - \log(x+1)$

Exponential Equations – *Section 3.4*

Solve the following for x

29. a) $2^{2x+17} = 8$ b) $10e^{3x-7} = 5$

30. a) $e^{2x} + 2e^{x} - 35 = 0$ b) $(7)^{2x} + 2(7)^{x} - 15 = 0$ c) $2e^{2x} + 3e^{x} - 20 = 0$

Domain of Logarithms function – *Section 3.2*

Find the domain of the following function;

31. a) $f(x) = \ln(6 - 2x)$

b) $f(x) = \log(4x + 16)$

Logarithms Equations – *Section 3.4*

32. a) Find the x-intercept of the following function $f(x) = 4 - 2\log_3(2x - 10)$

b) Find the y-intercept of the function $f(x) = \ln(2x + 3)$

33. Solve the following for x:

a) $\log_6(x) - \log_6(x - 5) = 2$

b) $\ln(x) + \ln(2x + 1) = 0$

More with polynomials and zeros – *Section 2.5*

34. Identify the zeros and the multiplicities of each zero for $f(x) = -2x^4(x + 3)^2(x - 7)^8$.

35. Construct a degree 4 polynomial with real coefficients with zeros at $3i$ (multiplicity 1), -4 (multiplicity 2) and with leading coefficient of 1.

36. Construct a degree 3 polynomial with real coefficients, with zeros at $2 + 3i$ (multiplicity 1), 5 (multiplicity 1), and with leading coefficient of 1.

37. Find all possible rational zeros from the conclusion of the Rational Root Theorem for the polynomial $f(x) = 2x^4 - x^3 + 2x + 21$

More with rational functions – *Section 2.6*

38. Construct a rational function with the following characteristics:

i. x-intercepts at (2,0) and (7,0)

ii. vertical asymptotes at $x = 4$ and $x = -5$

iii. horizontal asymptote at $y = 9$

Answers

1. 0, $\frac{7}{2} \pm \frac{1}{2}\sqrt{5}$ 2. 5, – 8, $\frac{3}{2}$ 3. 1, – 1, 3

4.zero at $\frac{-5}{2}$ mult. 1 and zero at 2 mult. 2

5. zero at –2 with mult. 1 and zero at 1 with mult. 2

6. zeros at –4, $\frac{5}{3}$, –5 with mult. of 1 for each.

7. rises left, falls right 8. falls left, falls right 9. falls left, rises right

10. Q: $2x^3 - 2x^2 - 4x + 4$ R: –3 11. Q: $2x - 3$ R: –2

12. Q: $2x^2 - x - 1$ R: 0

13. $x = \pm 1$ 14. $x = -\frac{1}{3}$ 15. $x = 2$

16. 5 hundred

17. 15 is the H.A., the average cost when producing a great number of games is \$15.

18. 0.16 ppm is the concentration after a long time.

19. $\log_a(65) = x + 1$ 20. $\ln(5) = 3x$ 21. $4x = 6^{10}$ 22. $B = e^A$

23. a) \$31,050.37 b) \$31,078.69 24. a) \$13,745.79 b) \$14,861.26

25. $5\log(x) + 7\log(y) - 3\log(z)$ 26. $\frac{3}{2}\ln(x-1) + 2\ln(y+3) - 4\ln(z)$

27. a) $\ln\left(\frac{x^2 w^9}{y^5}\right)$ b) $\ln\left(\frac{x+3}{x}\right)$ 28. a) $\log\left(\frac{A^3 C^5}{B^4 D^6}\right)$ b) $\log\left(\frac{8x-8}{x}\right)$

29. a) –7 b) $\frac{7 + \ln(1/2)}{3} = \frac{7 - \ln(2)}{3} \approx 2.102$

30. a) $\ln 5 \approx 1.609$ b) $\frac{\ln(3)}{\ln(7)} = \log_7(3) \approx 0.56458$ c) $\ln\left(\frac{5}{2}\right) \approx 0.916$

31. a) $(-\infty, 3)$ b) $(-4, \infty)$ 32. a) $(\frac{19}{2}, 0)$ b) $(0, \ln 3)$ 33. a) $\frac{36}{7}$ b) $\frac{1}{2}$

34. 0, multiplicity 4; –3, multiplicity 2; 7, multiplicity 8

35. $p(x) = (x^2 + 9)(x + 4)^2$ 36. $p(x) = (x - 5)(x^2 - 4x + 13)$

37 $\left\{\pm 1, \pm\frac{1}{2}, \pm 3, \pm\frac{3}{2}, \pm 7, \pm\frac{7}{2}, \pm 21, \pm\frac{21}{2}\right\}$ 38. $r(x) = \frac{9(x-2)(x-7)}{(x-4)(x+5)}$