Math 111 – College Algebra
CCC – Fall 2021
Instructor: Tim Brown

SCORE: _____

NAME: _____

TEST #2

✓ Pick 10 of 11. If you work all 11 problems, your grade will reflect your best 10 answers.

✓ You may use approved technology (such as a graphing calculator) on this test.

✓ You may use your own paper on this test.

✓ You may submit your answers in Canvas or directly to me by email.

✓ You **must** show all of your work to receive full credit when appropriate.

✓ NO WORK = NO CREDIT!!

✓ Complete the box below. This is mandatory! If you are unable to print this page, make a duplicate of the box below and submit it along with your paper.

By checking the box and signing below, you are certifying that the following answers to this test are yours and yours alone. You are certifying that you did not collaborate with anyone, nor access any material except the textbook, homework, eLearn content, notes that you produced and approved technology.

☐ **I agree. The following answers are mine and mine alone.**

_____
Sign Here

The questions for this test start on the next page.

1. Consider the class of polynomials $P(x) = ax^7 + bx^5 + cx^3 + dx$ for nonzero real numbers a, b, c, d.

   (a) What is the degree of $P(x)$? _____

   (b) What is the leading term of $P(x)$? _____

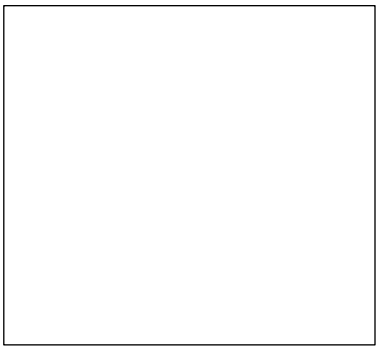
   (c) What is the leading coefficient of $P(x)$? _____

   (d) How many zeros (counting real, imaginary and multiplicities) does $P(x)$ have? _____

   (e) What is the maximum number of turning points that $P(x)$ can have? _____

   (f) BONUS (2 points): Is it possible that $P(x)$ has no x-intercepts? (Yes/No) _____

2. Assuming $a > 0$, sketch the end behavior of the polynomial in Problem 1.
   BONUS (2 points): Describe the end behavior symbolically.

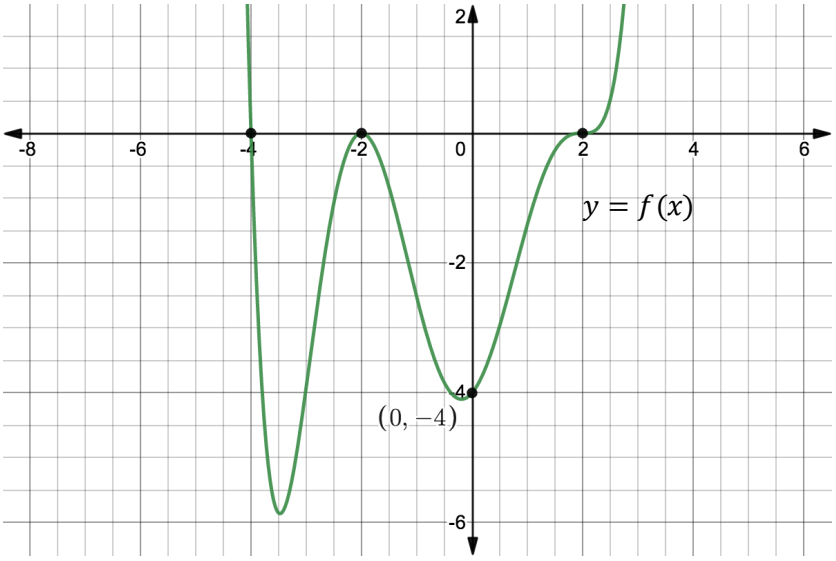


3. Follow the instructions below to complete the problems on symmetry.

   (a) Determine if the polynomials in Problem 1 are even, odd or neither. Justify your answer.

   (b) Use the symbolic test to prove $f(x) = \dfrac{|x|}{1 + x^2}$ is even.

Use the graph of the polynomial shown below to complete Problems 4-6.



4. Estimate the extrema of $f(x)$. Write your answers in the table below.

TYPE	Minimum	Maximum
Local		
Absolute		

5. Write the complete factored form of $f(x)$. (Assume the minimum degree possible.)

6. Solve the inequality $f(x) < 0$ using the graph above. Write the solution set in interval notation.

7. Use the rational zero test to find the zeros of the polynomial function: $f(x) = x^3 + 4x^2 - 16x + 35$.
Use synthetic division to find the first zero and the quadratic formula to find the remaining two zeros.

8. For the given rational function, answer the following questions.

$$R(x) = \frac{2x + 10}{x^2 + 6x + 5}$$

(a) What is the domain of $R(x)$? _____

(b) What are the x-intercept(s) of $R(x)$, if any? _____

(c) What is the y-intercept of $R(x)$? _____

(d) Give the equation(s) for any vertical asymptotes of $R(x)$. _____

(e) Give the equation(s) for any horizontal asymptotes of $R(x)$. _____

(f) Give the coordinates for any holes of $R(x)$. _____

(g) BONUS (2 points): Prove that the graph of $R(x)$ does not intersect its horizontal asymptote(s).

(h) Sketch the graph of $R(x)$ identifying all intercepts, asymptotes, holes and test points.

9. Find the slant asymptote of the rational function: $f(x) = \dfrac{5x^2 + 20x - 1}{x - 3}$

10. Consider the polynomial function: $P(x) = (x+1)^2(x-1)(x-3)^2$.

(a) What are the zeros of $P(x)$?
(b) State the multiplicity of the zeros of $P(x)$.
(c) Use the multiplicity test to determine whether $P(x)$ crosses or is tangent to the x-axis at its zeros.
(d) Sketch the graph of $P(x)$ identifying all intercepts and test points.

11. The data in the table lists the number of monthly active Facebook users worldwide in billions.

Year	2015	2016	2017	2018	2019	2020
Users	1.59	1.86	2.13	2.32	2.50	2.80

(a) Use cubic regression to model the data. (Let x = 0 correspond to 2015, x = 1 correspond to 2016, etc.) Write down the equation below. Round to 4 decimal places.
(b) Use this model to predict users in 2021.
(c) Explain why cubic regression may or may not be better than linear or quadratic regression.