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UF | UNIVERSITY of FLORIDA

Department of Mathematics

MAC 1140
Exam 2D
Fall 2019

A. Sign your bubble sheet on the back at the bottom in ink.

B. In pencil, write and encode in the spaces indicated:

1) Name (last name, first initial, middle initial)

2) UF ID number

3) Section number

C. Under "special codes" code in the test ID numbers as shown below.

1 ● 3 4 5 6 7 8 9 0
1 2 3 ● 5 6 7 8 9 0

D. At the top right of your answer sheet, for "Test Form Code", encode D.

A B C ● E

E. 1) The time allowed is 90 minutes.

2) You may write on the test.

3) Raise your hand if you need more scratch paper or if you have a problem with your test. DO NOT LEAVE YOUR SEAT UNLESS YOU ARE FINISHED WITH THE TEST.

F. KEEP YOUR BUBBLE SHEET COVERED AT ALL TIMES.

G. When you are finished:

1) Before turning in your test **check carefully for transcribing errors**. Any mistakes you leave in are there to stay.

2) You must turn in your scantron and tearoff sheets to your discussion leader or exam proctor. Be prepared to show your picture I.D. with a legible signature.

3) The answers will be posted in Canvas within one day after the exam. Your discussion leader will return your tearoff sheet with your exam score in discussion. Your score will also be posted in Canvas within one week of the exam.

7. Which of the following equations are polynomials?

I: $f(x) = x^2 + 1$

II: $g(x) = \frac{1}{3}x^3 + 7$

III: $h(x) = 7$

IV: $k(x) = x^3 + 3x^{\frac{1}{3}} + 1$

A) All of them are Polynomials. **B)** I, II, and III Only. **C)** I Only.
D) I and II Only. **E)** IV Only.

8. Consider the polynomial $f(x) = x^2 - 3x - 54$. Which of the following statements are true?

I: $f(x)$ has 2 roots but no real zeros.

II: $f(x)$ has 2 roots and 2 real zeros.

III: $f(x)$ is degree 2 which is why it must have 2 real zeros.

IV: $f(x)$ is degree 2 but has no real zeros.

A) Only II and III are correct **B)** Only II is correct.
C) None of these are correct. **D)** Only I is correct
E) Only I and IV are correct

9. Consider the polynomial $p(x) = x^4 + 9x^3 + 20x^2 + 12x$. Which of the following are true?

I: $p(x)$ is degree 4.

II: $p(x)$ has 4 real zeros.

III: The sum of the zeros of $p(x)$ is -9.

IV: The product of the zeros of $p(x)$ is 0.

A) All of these are correct. **B)** Only I and IV are correct
C) Only I is correct **D)** Only I, II and IV are correct
E) Only I, III, and IV are correct.

1. Consider the polynomial $p(x) = 4x^5 - 3x^3 - x^2 + x - 2$. What can be said about the extrema of $p(x)$?
   A) There is nothing we can deduce about the extrema of $p(x)$ without a graph.
   B) $p(x)$ does have an absolute extrema and it has at most 4 local extrema.
   C) $p(x)$ does not have an absolute extrema and it has at most 4 local extrema.
   D) $p(x)$ does not have an absolute extrema and it has at most 5 local extrema.
   E) $p(x)$ does have an absolute extrema and it has at most 5 local extrema.

2. What is the remainder when $x^4 - 2x^3 - 28x^2 + 51x + 75$ is divided by $x^2 + 2x - 15$?
   A) 0 **B)** $-x$ **C)** x **D)** $x - 3$ **E)** $x - 5$

3. What is the fully factored form (with real coefficients) for the polynomial $f(x) = x^6 - 729$? (Hint: $3^6 = 729$)
   A) $(x^2 - 9)(x^4 + 9x^2 + 81)$ **B)** $(x - 3)^3(x + 3)^3$. **C)** $(x - 3)^2(x + 3)^4$
   D) $(x - 3)(x + 3)(x^2 + 3x + 9)(x^2 - 3x + 9)$. **E)** $(x - 3)^4(x + 3)^2$

4. Consider the polynomial $p(x) = x^3 - 2x^2 - 25x + 50$. What is the sum of the zeros of $p(x)$?
   A) 12 **B)** -2 **C)** 2 **D)** $\frac{12}{5}$ **E)** -8

5. What is the fully factored form (with real coefficients) for the polynomial $f(x) = x^4 - 625$? (Hint: $5^4 = 625$)
   A) $(x^2 - 25)(x^2 + 25)$ **B)** $(x - 5)(x + 5)^3$ **C)** $(x - 5)^2(x + 5)^2$.
   D) $(x - 5)(x + 5)(x^2 + 25)$.
   E) $x^4 - 625$ (It is already irreducible with real coefficients).

6. Consider the polynomial $p(x) = 4x^6 - 6x^5 + 2x^4 - 3x^3 - 12x^2 + 18x$ and the following techniques from class;

   I: Rational Root Theorem

   II: Completing the Square

   III: Synthetic Division

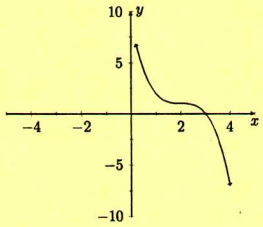
   IV: Factor by Grouping

   V: AC-Method

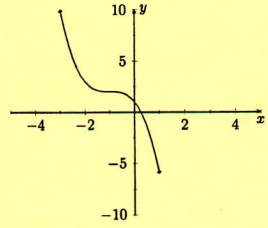
   Which of the previous techniques are possible techniques one could use as the **first factoring** technique on $p(x)$? (In other words, which of the above can you apply directly to $p(x)$ without any additional techniques, to factor $p(x)$ into the product of two or more polynomials.)
   A) None of these can be used to factor $p(x)$. **B)** I, IV, and V.
   C) I, II, and III. **D)** I, III, and V. **E)** IV.

15. Which of the following is the graph of $f(x) = (-x+2)^3 - 1$?

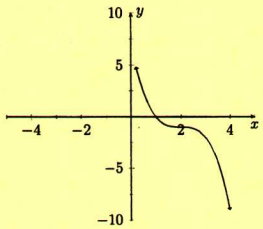
A)



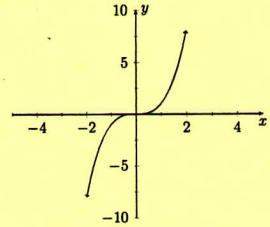
B)



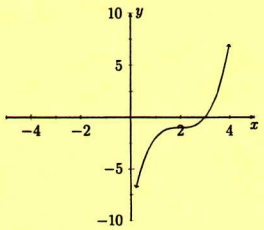
C)



D)



E)



10. Consider the polynomial $p(x) = -8x^3 - 26x^2 + 9x + 45$ for the next 3 questions.

How many roots does this polynomial have counting multiplicity?

A) 4 **B)** 2 **C)** 3 **D)** 1 **E)** 5

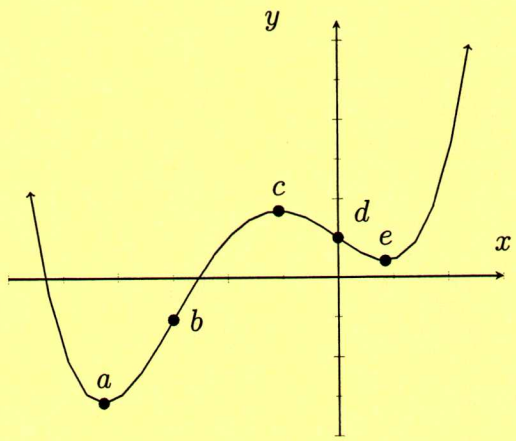
11. What are the (real-valued) zeros of $p(x)$?

A) $-\frac{3}{2}, \frac{5}{4}, \frac{1}{3}$ **B)** $-\frac{3}{2}, -\frac{4}{5}, -3$ **C)** $\frac{2}{3}, \frac{5}{4}, -3$ **D)** $\frac{2}{3}, -\frac{4}{5}, \frac{1}{3}$
E) $-\frac{3}{2}, \frac{5}{4}, -3$

12. What are the zeros of $-2p(x-3)$?

A) $-\frac{9}{2}, \frac{17}{4}, 0$ **B)** $\frac{3}{2}, \frac{17}{4}, 0$ **C)** $\frac{3}{2}, -\frac{7}{4}, 0$ **D)** $-\frac{9}{2}, -\frac{7}{4}, -6$
E) $\frac{3}{2}, \frac{17}{4}, -6$

13. Consider the following graph of $f(x)$ for the next 2 questions.



Based on the number of extrema, what is the smallest degree possible for the leading term of f?

A) 5 **B)** 4 **C)** 6 **D)** 3

14. Within which of the following segments is the function **increasing** and concave **down**?

A) Between b and c **B)** Between d and e **C)** Between a and b
D) To the right of e **E)** Between c and d

Name: **Section:**

Signature: **UFID:**

YOU MUST **SHOW ALL WORK** TO GET CREDIT!

1) Consider the polynomial: $p(x) = -2x^4 - 4x^3 + 40x^2 + 132x + 90$

(a) First factor $p(x)$ to it's irreducible forms with real coefficients (Hint: This should yield all linear factors).

(b) What are the:

i. Roots of this polynomial?

ii. Zeros of this polynomial?

iii. x-intercepts of this polynomial?

iv. y-intercepts of this polynomial?

v. domain of this polynomial?

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Now consider the function $g(x) = p(x - 2)$.

(c) Factor $g(x)$ into irreducible forms with real coefficients.

(d) How have the **zeros** changed compared to $p(x)$? Describe this change in words as well as providing the new zeros.

Now consider the function $h(x) = p(-6\,x)$.

(e) Factor $h(x)$ into irreducible forms with real coefficients.

(f) How have the **intercepts** of $h(x)$ changed compared to $p(x)$? Describe this change in words as well as providing the new intercepts (Hint: Be careful to include *all* intercepts as well as how you describe the changes!).

Now consider the function $s(x) = 10p(-5x)$.

(g) Factor $s(x)$ into irreducible forms with real coefficients.

(h) How have the **roots** of $s(x)$ changed compared to $p(x)$? Describe this change in words as well as providing the new roots (Remember the general form of a root and how 0 works!).