

MAC 1147  
Fall 2021

**EXAM 2A**

- A. Sign and date your scantron on the back at the bottom.
- B. In pencil, write and encode in the spaces indicated on your scantron:
- 1) Name (last name, first initial, middle initial)
  - 2) UF ID Number
  - 3) Section Number — Do not fill this out.
- C. Under “special codes” on your scantron, code in the test ID number 2, 1.
- |                                  |                                  |   |   |   |   |   |   |   |   |
|----------------------------------|----------------------------------|---|---|---|---|---|---|---|---|
| 1                                | <input checked="" type="radio"/> | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| <input checked="" type="radio"/> | 2                                | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
- D. At the top right of your scantron, for “Test Form Code”, encode A.
- B   C   D   E
- E. 1) This exam has 23 multiple-choice questions and 2 free response questions. Each question has equal weight.
- 2) The time allowed is 90 minutes.
- 3) You may write on the test.
- 4) 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 SCANTRON COVERED AT ALL TIMES.**
- G. When you are finished:
- 1) Before turning in your test, check for transcribing errors. Any mistakes you leave in are there to stay.
  - 2) Take your test, scratch paper, and scantron to your TA. Be prepared to show your UF ID card.
  - 3) Answers will be posted in Canvas after the exam.
- H. By taking this exam, you agree to the following **Honor Pledge**:

**“I will neither give nor receive any unauthorized aid for this exam.”**

Questions 1–23 are worth 4 points each.

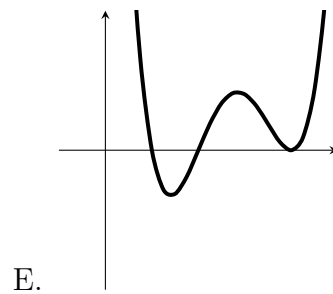
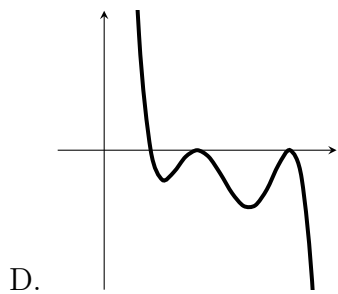
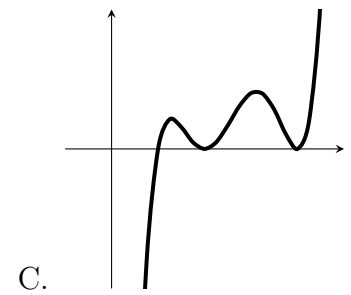
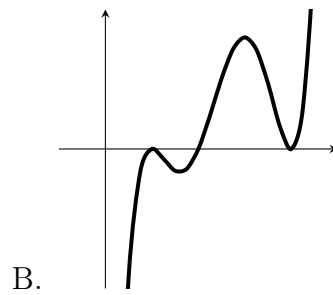
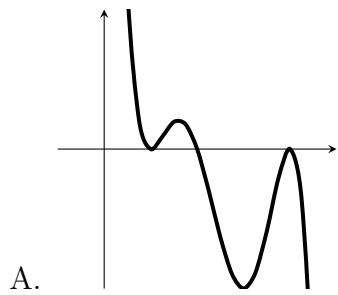
1.  $g(x)$  is a linear function perpendicular to  $f(x) = \frac{4}{3}x + 7$ . The two functions intersect when  $x = 2$ . What is the  $x$ -intercept of  $g(x)$ ?

- A.  $x = \frac{127}{9}$       B.  $x = \frac{148}{9}$       C.  $x = \frac{134}{9}$       D.  $x = \frac{71}{3}$       E.  $x = \frac{29}{3}$
- 

2. Select the function that has exactly one  $x$ -intercept.  $f(x) = \dots$

- A.  $-3x^2 + 12x - 12$       B.  $2x^2 - 16x + 25$       C.  $4x^2 - 8x + 9$   
 D.  $-2x^2 + 8x - 11$       E.  $-3x^2 + 24x - 43$
- 

3. Which of these could be the graph of  $p(x) = (x - 1)^2(x - 2)^1(x - 4)^2$ ?



4. Select the rational function which has the following properties:

- Has a zero of multiplicity 2 at  $x = -1$  and a zero of multiplicity 1 at  $x = 1$ .
- Has a vertical asymptote at  $x = 2$ .
- Has a hole at  $x = 5$ .
- Has a horizontal asymptote of  $y = 0$ .

$f(x) = \dots$

A.  $\frac{(x-5)(x+1)^2(x-1)}{(x-5)(x-2)}$

B.  $\frac{(x-5)(x+1)(x-1)^2}{(x-5)(x-2)}$

C.  $\frac{(x-5)(x+1)^2(x-1)}{(x-5)^4(x-2)}$

D.  $\frac{(x-5)(x+1)^2(x-1)}{(x-5)(x-2)^5}$

E.  $\frac{(x-5)(x-2)}{(x-5)(x+1)^2(x-1)}$

5.  $i^{245} =$

A. 1

B.  $i$

C.  $-1$

D.  $-i$

E. The greatest power in the known universe

6. Select the *false* statement.

A. If  $f(x) = \frac{p(x)}{q(x)}$  is a rational function with a vertical asymptote at  $x = 7$ , then  $x - 7$  must be a factor of  $q(x)$ .

B. The graphs of  $f(x) = -x^2$  and  $g(x) = x^2 - 8x + 16$  do not intersect.

C. If a rational function  $f(x)$  has a hole at  $x = 4$  then  $f(4)$  is undefined.

D.  $g(x) = 2x^3 + 7x^2 - 4x + 5$  is a rational function.

E. A rational function can have two horizontal asymptotes.

7. Choose the solution to the inequality

$$\frac{x^2 - 7x}{x^3 - 8} \geq 0$$

A.  $(-\infty, 0] \cup [7, \infty)$

B.  $(-\infty, 0] \cup (2, 7]$

C.  $(2, 7]$

D.  $[0, 2) \cup [7, \infty)$

E.  $[0, 2)$ 

---

8. Simplify, assuming  $x > 2$ .

$$\frac{12 - 3x^2}{x^2 + 8x + 12} \cdot \frac{x^3 + 7x^2 + 14x + 48}{x - 2} =$$

A.  $3(x^2 - x + 8)$

B.  $-3(x^2 - x + 8)$

C.  $-3(x^2 + x + 8)$

D. 1

E.  $3(x^2 + x + 8)$ 

---

9. Multiply the complex numbers.

$$(4 + 3i)(7i + 2i^2) =$$

A.  $-13 - 34i$

B.  $29 - 22i$

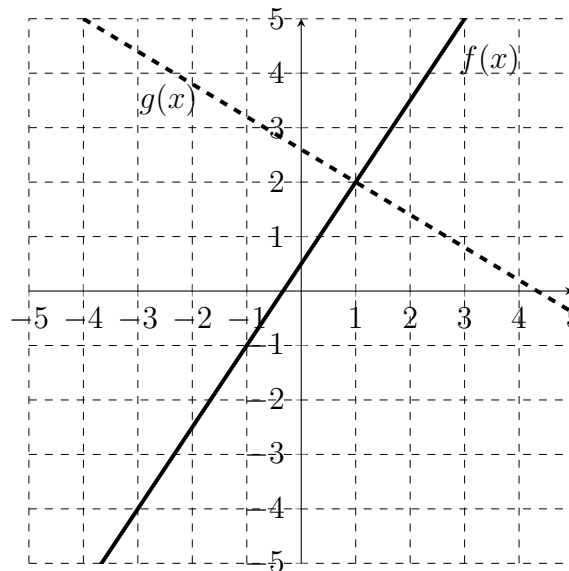
C.  $22 + 29i$

D.  $13 + 34i$

E.  $-29 + 22i$ 

---

10. Which interval is the solution to the inequality  $g(x) \geq f(x)$ ?



- A.  $(-\infty, 2]$       B.  $[2, \infty)$       C.  $(-\infty, 1]$       D.  $[1, \infty)$       E.  $(-\infty, \infty)$

11. Choose the solution to the inequality

$$t^3 - 11t^2 + 32t - 28 < 0$$

- A.  $(-\infty, 2) \cup (2, 7)$       B.  $(-\infty, \infty)$       C.  $(-\infty, 2) \cup (7, \infty)$   
 D.  $(-\infty, 7)$       E.  $(2, 7)$

12. Suppose  $f(x) = x^2 - 8x + 23$  is a quadratic function.  $g(x)$  is a linear function with slope 2 that passes through the vertex of  $f(x)$ . What are the coordinates of the other intersection point of  $f(x)$  and  $g(x)$ ?

- A.  $(6, 11)$       B.  $(2, 11)$       C.  $(4, 6)$       D.  $(6, 7)$       E.  $(4, 7)$

13. Choose the solution to the inequality

$$-3|x - 5| + 11 \leq -13$$

- A.  $(-\infty, -3] \cup [5, 13]$       B.  $(-\infty, -3] \cup [13, \infty)$       C.  $[-3, 13]$   
D.  $[13, \infty)$       E. There are no solutions
- 

14. Let

$$P(z) = 35z^5 - 21z^4 + 42z^3 - 19z^2 + 8z + 66$$

Choose the value that could *not* be a zero of  $P(z)$  according to the Rational Root Test.

- A. 1      B.  $-\frac{11}{7}$       C.  $\frac{2}{3}$       D.  $-\frac{1}{5}$       E. -2
- 

15. Line  $A$  is parallel to the  $x$ -axis and passes through the point  $(4, 9)$ . Line  $B$  is perpendicular to the  $y$ -axis and passes through the point  $(-6, 1)$ . At what point do the two lines intersect?

- A.  $(4, 1)$   
B.  $(-6, 9)$   
C.  $(0, 9)$   
D.  $(-6, 0)$   
E. Lines  $A$  and  $B$  do not intersect
- 

16. Find the sum of all roots (real and complex) of the polynomial.

$$p(x) = x^4 - 4x^3 + 28x^2 + 4x - 29$$

- A. 3      B. 6      C.  $4 + 10i$       D.  $3 - 10i$       E. 4
-

17. Subtract and simplify, assuming  $x > 7$ .

$$\frac{15x-69}{x^2-9x+20} - \frac{6x-42}{x^2-12x+35}$$

- A.  $\frac{6}{x-5}$       B.  $\frac{7}{(x-4)(x-5)}$       C.  $\frac{9}{x-4}$       D.  $\frac{4}{(x-5)(x-7)}$       E. 1

18. Select the *true* statement about a polynomial  $f(x)$  with real coefficients.

- A. If the leading coefficient of  $f(x)$  is negative, then  $f(x)$  has no real number roots.  
 B. If  $4 + 7i$  and  $4 - 7i$  are the only zeros of  $f(x)$ , then  $f(x)$  has an odd degree.  
 C. If  $5 + 2i$  is a zero of  $f(x)$ , then  $x^2 + 29$  must be one of its factors.  
 D. If  $f(x)$  has degree larger than 1 at least one root, then product of all of its roots is a real number.  
 E. If  $x = a$  is a zero of  $f(x)$  then  $(x + a)$  is a factor of  $f(x)$

19. Which statement describes the behavior of  $f(x)$ ?

$$f(x) = -8x^5 + 9x^4 - 2x^3 + 11x^2 + 5x + 13$$

- A. As  $x \rightarrow \infty$ ,  $f(x) \rightarrow \infty$  and as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -\infty$   
 B. As  $x \rightarrow \infty$ ,  $f(x) \rightarrow -\infty$  and as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow \infty$   
 C. As  $x \rightarrow \infty$ ,  $f(x) \rightarrow -\infty$  and as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -\infty$   
 D. As  $x \rightarrow \infty$ ,  $f(x) \rightarrow \infty$  and as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow \infty$   
 E.  $f(x)$  takes long walks on the beach and plays guitar.

20. Identify the horizontal asymptote of the function.

$$f(x) = \frac{8x^6 + 3x^5 + 7x^2}{5x^5 + 11x^4 + 2x^3}$$

- A.  $y = 0$
  - B.  $y = \frac{8}{5}$
  - C.  $y = \frac{7}{2}$
  - D.  $y = 1$
  - E.  $f(x)$  has no horizontal asymptote
- 

21. Which quadratic function has vertex  $(3, -7)$  and passes through the point  $(5, 1)$ ?

- A.  $f(x) = 2x^2 - 12x - 11$
  - B.  $f(x) = 2x^2 - 12x + 11$
  - C.  $f(x) = x^2 - 6x - 2$
  - D.  $f(x) = x^2 - 6x + 2$
  - E.  $f(x) = 2x^2 - 6x + 2$
- 

22. Which of these could be the graph of

$$g(x) = \frac{x}{(x+3)(x-4)^2}$$

- A.

B.

C.
- D.

E.
-



23. Which value of  $b$  in the system below will produce a system with no solutions?

$$\begin{aligned}4x + 7y &= 21 \\ -12x + by &= -68\end{aligned}$$

A.  $-7$

B.  $0$

C.  $7$

D.  $-21$

E.  $21$

---

T.A. \_\_\_\_\_ Disc. Per. \_\_\_\_\_ Name \_\_\_\_\_

**Honor Pledge: "On my honor, I have neither given nor received unauthorized aid for this exam."**

UF ID # \_\_\_\_\_ Signature \_\_\_\_\_

**YOU MUST SHOW ALL WORK TO RECEIVE FULL CREDIT.**

Free response questions 24-25 are worth 4 points each.

24.  $f(x)$  is a parabola that passes through the points  $(2, 13)$ ,  $(6, 13)$  and  $(0, 37)$

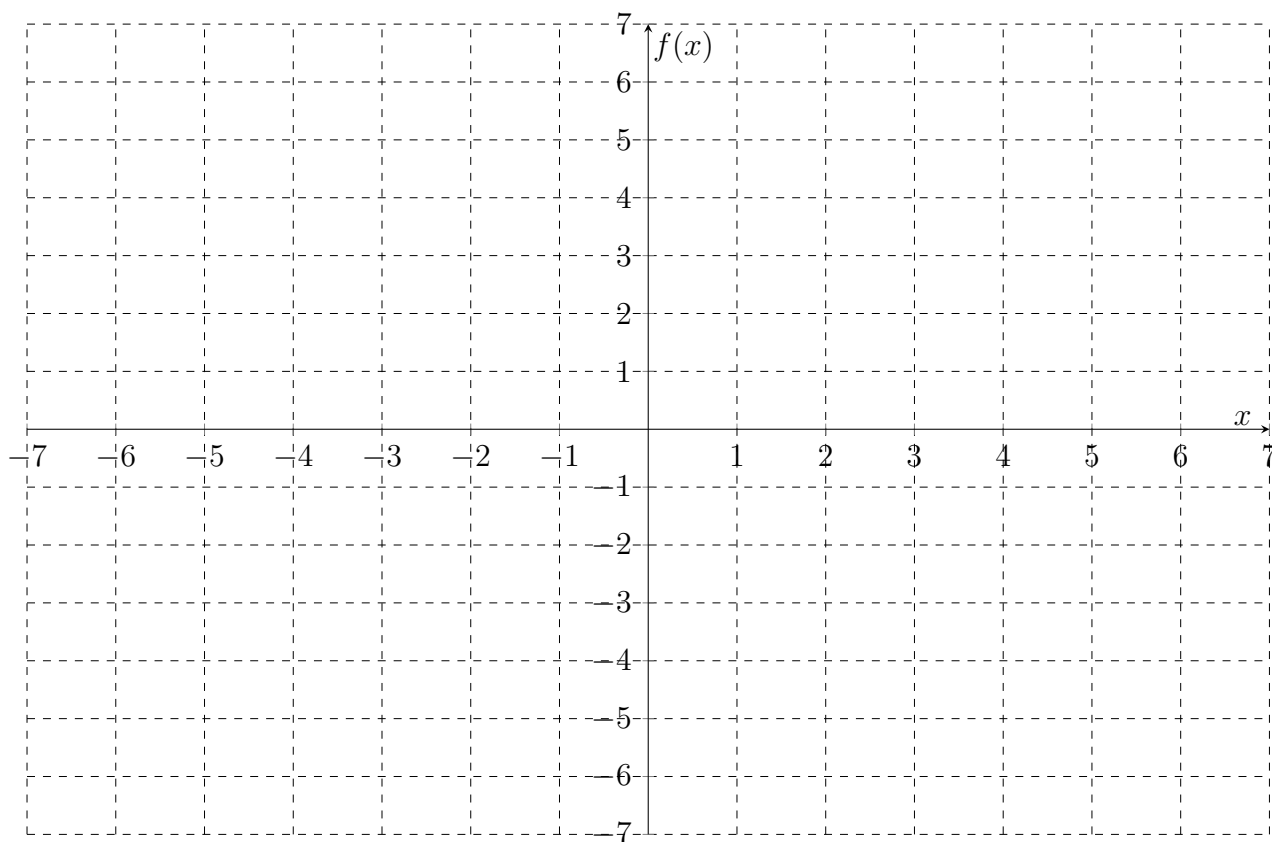
a. (3 pts)  $g(x)$  is formed by shifting the graph of  $f(x)$  down vertically by 13 units. Find a formula for  $g(x)$  in standard form.

*Hint: Write the coordinates of some points on  $g(x)$ .*

b. (1 pt) Find a formula for  $f(x)$  in standard form.

25. Construct a rational function  $f(x)$  with the properties listed below. Write the formula for your function in factored form and sketch its graph. Each property is worth 1 point and must be evident in both graph and formula.

- $f(x)$  has exactly one positive  $x$ -intercept and exactly one negative  $x$ -intercept
- $f(x)$  has exactly one vertical asymptote between its  $x$ -intercepts
- $f(x)$  has a horizontal asymptote below the  $x$ -axis
- $f(x)$  has a positive  $y$ -intercept



$f(x) =$  \_\_\_\_\_

Turn in your scantron and your free response to your TA. The worked-out solutions will be posted on Canvas after the test.