

IUPUI Department of Mathematical Sciences  
Departmental Final Examination

PRACTICE FINAL EXAM VERSION #3

**MATH 15300**

**College Algebra**

Exam directions similar to those on the departmental final.

1. **DO NOT OPEN** this test booklet until you are told to do so.
2. This is **NOT** the exam for MATH 15400 or 15900.
3. There are 9 pages in this exam booklet with problems 1 to 24 and a bonus problem.
4. You **MUST** get a new exam from the proctor if your exam is incomplete.
5. **PRINT** your name and student ID# below.
6. **MARK** your section below.
7. You will have two hours to complete this examination.
8. A TI-30Xa calculator is permitted, no other calculator is allowed.
9. No scrap paper, notes, books, or collaborators are allowed.
10. Exact answers may contain  $\pi$  or radicals or logarithms.
11. Simplify all answers completely.
12. Problems involving units must have the units represented on the answer to receive full credit.

<b>Name</b> (Print Clearly)	
<b>Student ID#</b>	

**Practice Departmental Final Exam Recommendations to Students:**

- Take this practice final exam like an actual examination (not like doing homework). That is, create an “exam like” atmosphere. This practice exam should be taken after completing a thorough review of the material.
- Set aside a two-hour block of time with no interruptions (no facebook, texting, phone calls, restroom breaks, etc.).
- Do not use any help aids, such as notes, textbook, internet, scrap paper, MAC staff, etc.
- Work through all problems noting which concepts you know well and which ones you need to spend more time on.
- Grade your exam using the Practice Final Version 3 Solutions posted on the Math Department website (math.iupui.edu).  
Go to math.iupui.edu, then the “Undergraduate” tab, then the “Courses” tab, and then scroll down to MATH 15300.
- Rework any problem on the exam that you missed and then work similar problems from the textbook until you can perform the operations without error.

## MATH 15300 Practice Final Exam Version 3

To receive full credit you must show all your work and simplify all answers completely. Be sure to check your final answers for errors. Problems involving units must have the units represented on the answer to receive full credit.

1. Given the points  $A(-3, -2)$  and  $B(1, -4)$  in the  $xy$ -plane:

a) Find an equation of the line passing through  $A$  and  $B$ . Express your answer in **slope-intercept** form.

1a) \_\_\_\_\_ (4)

b) Find an equation for the **perpendicular bisector** of the segment  $AB$ .  
Express your answer in **slope-intercept** form.

1b) \_\_\_\_\_ (4)

2. Solve the equation using the **quadratic formula**. Find the **exact values** for the solution and simplify.

$$\frac{1}{3}x^2 + x + \frac{1}{2} = 0$$

2. \_\_\_\_\_ (4)

3. Write the expression in the form  $a + bi$  where  $a$  and  $b$  are real numbers.

$$\frac{-2+7i}{3+4i}$$

3. \_\_\_\_\_ (4)

4. Simplify the expression and **rationalize the denominator**.

$$\sqrt[5]{\frac{81x^6}{y^2}} \sqrt[5]{\frac{9x^2}{x^{-3}y^4}}$$

4. \_\_\_\_\_ (4)

5. Factor the polynomial **completely**.

$$9x^5 - 4x^3 - 9x^2 + 4$$

5. \_\_\_\_\_ (4)

6. Simplify the expression **completely**.

$$\frac{(x^2 - 1)^{1/2} (4) - (4x) \left(\frac{1}{2}\right) (x^2 - 1)^{-1/2} (2x)}{\left[(x^2 - 1)^{1/2}\right]^2}$$

6. \_\_\_\_\_ (4)

7. Set up an appropriate equation and solve.

**Mixing solutions** A biologist has two brine solutions, one containing 5% salt and another containing 20% salt. How many milliliters (mL) of each solution should they mix to obtain 1000 mL of a solution that is 14% salt?

7. \_\_\_\_\_ (4)

8. Solve the inequality and express the solution in terms of **intervals**.

$$-\frac{1}{3}|2-5x|+10 \geq 4$$

8. \_\_\_\_\_ (4)

9. Solve the inequality and express the solution in terms of **intervals**.

$$\frac{1}{x-1} \geq \frac{2}{x+6}$$

9. \_\_\_\_\_ (4)

10. Find the standard form for an equation of the circle that satisfies the stated condition. Endpoints of a diameter  $A(-7, 8)$  and  $B(3, 4)$ .

10. \_\_\_\_\_ (4)

11. Find the **center** and **radius** of the circle with the given equation.

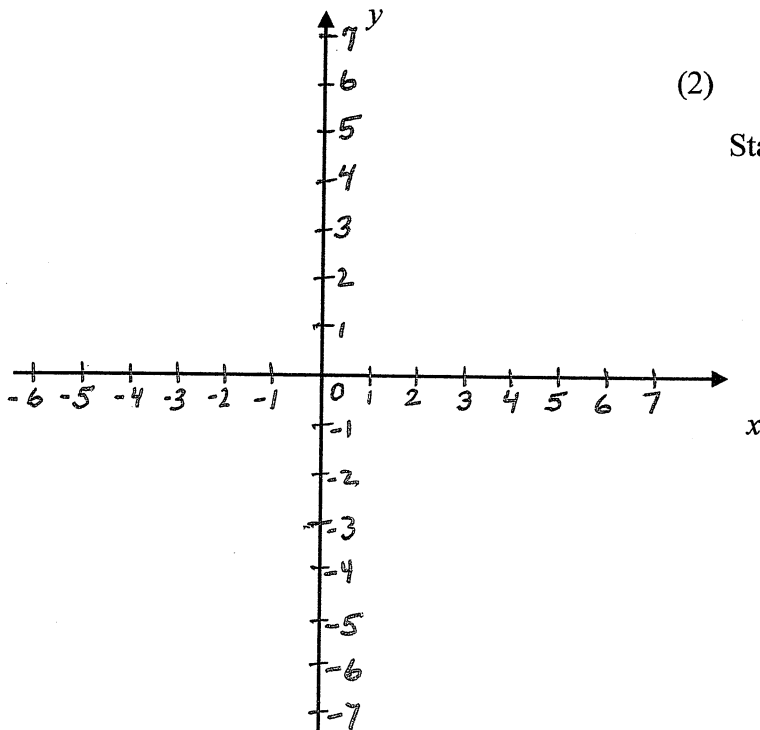
$$x^2 + y^2 - 10x + 4y - 20 = 0$$

11. \_\_\_\_\_ (4)

12. Simplify the difference quotient  $\frac{f(x+h) - f(x)}{h}$  if  $h \neq 0$  for the function  $f(x) = 3x^2 - 2x + 5$ .

12. \_\_\_\_\_ (4)

13. Express  $f(x) = -x^2 + 6x - 5$  in standard form, i.e.,  $f(x) = a(x-h)^2 + k$ , and sketch the graph of  $f(x)$ .



(2)

Standard form: \_\_\_\_\_ (2)

14. Find the domain of  $f(x) = \frac{\sqrt{2-3x}}{x^2-x-12}$ . Express your answer in **interval notation**.

14. \_\_\_\_\_ (4)

15. **Height of a projectile** An object is projected vertically upward from the top of a building with an initial velocity of 112 ft/sec from a height of 90 feet. Its height  $s(t)$  in feet above the ground at time  $t$  in seconds is given by the equation  $s(t) = -16t^2 + 112t + 90$ . Find the maximum height of the object above the ground.

15. \_\_\_\_\_ (4)

16. Let  $f(x) = \frac{x+3}{x^2-4}$  and  $g(x) = \frac{x+3}{x+2}$ .

- a) Find the function  $\frac{f}{g}(x)$  and simplify completely.

16a) \_\_\_\_\_ (2)

- b) Find the domain of  $\frac{f}{g}(x)$ . Use **set-builder notation** to express your answer.

16b) \_\_\_\_\_ (2)

17. Given  $f(x) = \frac{x-3}{x+2}$  and  $g(x) = \frac{x-1}{x-4}$ .

a) Find the composite function,  $(f \circ g)(x)$ , and simplify completely.

17a) \_\_\_\_\_ (2)

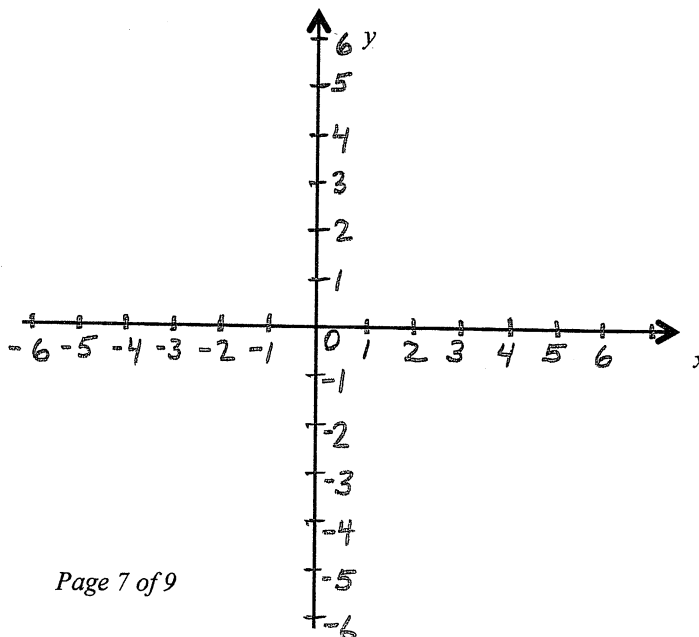
b) Find the domain of  $(f \circ g)(x)$ .

17b) \_\_\_\_\_ (2)

18. Given the one-to-one function  $f(x) = \frac{3x}{2x-5}$ , find the inverse function,  $f^{-1}(x)$ .

18. \_\_\_\_\_ (4)

19. Given  $f(x) = (x+2)(x-1)^2$ . Sketch the graph of  $f(x)$  showing the y-intercept. Plot two extra points.



(4)

20. Find the quotient and remainder if  $f(x)$  is divided by  $p(x)$ .

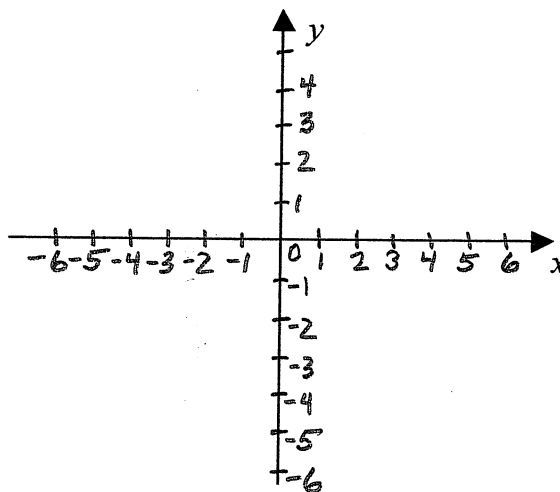
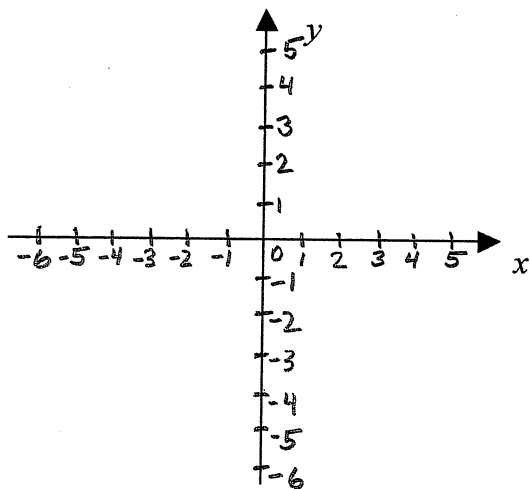
$$f(x) = 2x^3 - 3x^2 - 7; \quad p(x) = x - 3$$

20. \_\_\_\_\_ (4)

21. Graph each function using at least three points and dash in the asymptote.

a) Graph  $f(x) = e^{-x} - 3$ . (2)

b) Graph  $f(x) = \log_2(x+4)$ . (2)



22. **Compound interest** Chase Bank's current 4-year CD (Certificate of Deposit) has an annual rate of interest of 1.55% on amounts from \$100K-\$200K. Find the future value of a deposit of \$135000 in 4 years

a) if interest is compounded monthly. Round your answer to the nearest one cent (two decimal places).

22a) \_\_\_\_\_ (2)

b) if interest is compounded continuously. Round your answer to the nearest one cent.

22b) \_\_\_\_\_ (2)



23. Solve. Find the **exact value(s)** for the solution.

$$\ln x + \ln(x+2) = \ln(3x+6)$$

23. \_\_\_\_\_ (4)

24. Solve. Find the **exact value** (no calculator approximation) for the solution and **simplify completely using the laws of logarithms**.

$$2^{3x-1} = 3^{x+4}$$

24. \_\_\_\_\_ (4)

**Bonus: Radioactive Decay Half-life** Food irradiation is a technology for controlling spoilage and eliminating food-borne pathogens, such as salmonella. Cobalt-60 is the most commonly used radionuclide for food irradiation. The amount of Co-60 remaining after  $t$  years is given by  $A(t) = A_0e^{-0.1315t}$ , where  $A_0$  is the initial amount present and  $A(t)$  is the amount present at time  $t$  (in years). What is the half-life of Cobalt-60? Round your answer to two decimal places.

**Bonus:** \_\_\_\_\_ (4)