

The final examination will include mainly problems which are more or less similar in type and content to the ones herein. Problems of other sorts may appear as well. The actual final examination may include other problems which are suitable for Mathematics 115 but are not exactly like any of the problems herein.

You must show your work for each problem in order to receive credit for it. All examples must be done algebraically. No credit will be given for answers obtained by trial and error.

1. (a) Simplify. Express all answers with positive exponents and exactly evaluate all numbers. Assume all letters represent positive quantities.

i) $\left(\frac{9a^{-3}b^2c^{-4}}{54a^6b^{-4}c^2}\right)^{-2}$

ii) $\left(3a^{2/5}b^{-4}\right)^{-1/2}$

iii) $\left(\frac{8}{27}\right)^{\frac{2}{3}} \cdot 2^{-4}$

(b) i) Fully simplify the radical expression

$$\sqrt[3]{16x^7y^5}$$

ii) Express your answer to part a (ii) in fully simplified radical form.

2. Compute and write the answer in scientific notation.

$$\frac{(6.4 \times 10^{120}) \times (2.1 \times 10^{-209})}{(7.0 \times 10^{-200}) \times (8.0 \times 10^{115})}$$

3. Factor completely.

(a) $4t^3 + 108$

(b) $x^4 - 12x^2 + 27$

(c) $7x^2 - 9xy + 2y^2$

(d) $x^3 - 3x^2 - 4x + 12$

4. (a) Perform the indicated operations and simplify: $(4x + 7y)^2 - (2x + 7y)(8x + 7y)$

(b) rationalize the denominator and simplify: $\frac{1 + \sqrt{2}}{\sqrt{5} + \sqrt{3}}$

5. Solve for x and check.

$$\frac{x+3}{x-2} + \frac{x+1}{x+2} = \frac{8+6x}{x^2-4}$$

6. Solve by quadratic formula.

$$3(x^2 + 1) = 5(1 - x)$$

7. Solve for x.

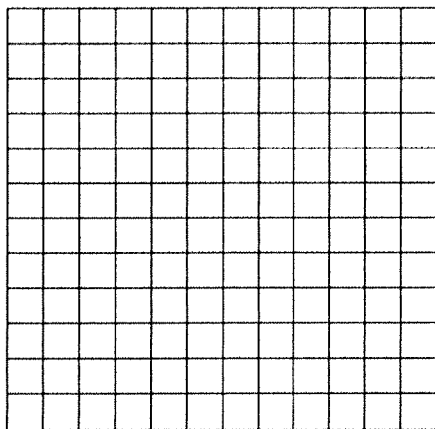
$$\sqrt{2x - 2} + \sqrt{x - 2} = 3$$

8. Find the centre and radius. $x^2 + y^2 - 16x + 14y + 17 = 0$.

9. (a) Find the slope and both intercepts:

$$\frac{x}{3} - \frac{y}{4} = 1$$

(b) Graph the equation and label with their coordinates both intercepts, and the point where $y = 4$.



10. Find an equation of the line passing through (3,4) and perpendicular to $2x - 3y + 4 = 0$.
Write your answer in (a) point-slope form (b) slope-intercept form and (c) general form.

11. Let $f(x) = \frac{1}{(x-1)}$, $g(x) = \sqrt{x}$. Find each of the following and rationalize any denominators:

(a) $(f + g)(x)$

(b) $(f - g)(x)$

(c) $(f \cdot g)(x)$

(d) $(f/g)(x)$

(e) $(g/f)(x)$

12. Let $f(x) = \frac{1}{x-2}$, $g(x) = \sqrt{x}$. Find each of the following and rationalize any denominators:

(a) $(f \circ g)(x)$

(b) $(f \circ g)(9)$

(c) $(g \circ f)(x)$,

(d) $(g \circ f)(6)$.

13. (a) Write graphical notation for the interval $[-5, -3)$.

(b) Write interval notation for the set $\{x|x \leq 2\}$.

(c) Write set notation for the interval $(-5, 5)$

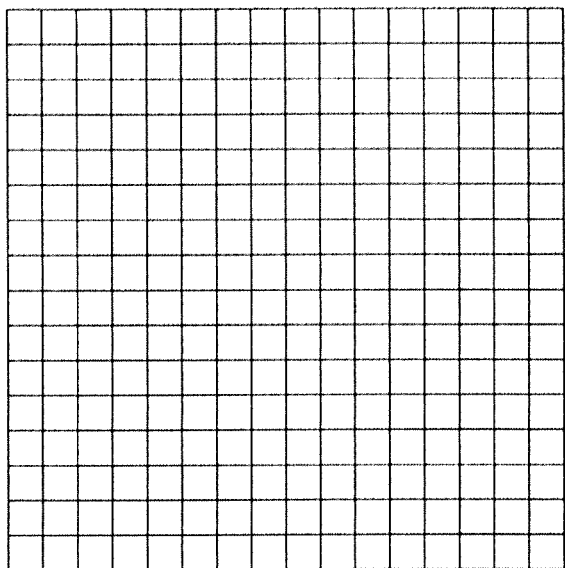
14. (a) Use completing the square to find the vertex. (*No credit if any other method used.*)

$$y = \frac{1}{2}x^2 + 2x + 1.$$

(b) state the axis of symmetry

(c) find the coordinates of all intercepts, if any exist

(d) graph the equation. Label with both their coordinates the vertex, any intercepts, and two other points and label the axis of symmetry.



15. Write the domain in interval form:

(a) $f(x) = \sqrt{42 - 7x}$

(b) $g(x) = \frac{1}{x^2 - 4x - 21}$

(c) $h(x) = \frac{\sqrt{x+7}}{x^2 - 4x - 21}$

16. Solve the system of equations. (*Must be done algebraically. Trial-and-error not acceptable.*)

$$300x + 400y = 2,000$$

$$4x + 5y = 26$$

WORD PROBLEMS

- 17.** Plane B travels at 500 mph, while plane D travels at 302 mph. Plane D leaves an airport first. One hour later, plane B departs the same airport taking the same route. How long will it take B to overtake plane D? (*Express answer first exactly as a rational number, then as its decimal equivalent to the nearest 0.01 hours.*)

18. A snack food manufacturer wishes to mix sesame sticks worth \$2.50 /lb. with Brazil nuts worth \$7.50/lb in order to make 20 lb. of a mixture worth \$4.50/lb..How much of each component should be used?

19. Al can paint a room in 1.5 hr.,Betty can paint the same room in 2.5 hours, and Vic can paint the same room in 3.5 hr. How long would it take to paint the room if all three worked together?

20. A bricklayer has sufficient cinder blocks to enclose a rectangular patio with 60 feet of block wall. If the wall of the adjacent house is used to form one side of the rectangle, find (a) the maximum area that can be enclosed and (b) the dimensions of the patio needed in order to achieve this area. (*carefully identify the two dimensions in relation to the house wall.*)

21. A vehicle travels 120 mi at a constant speed . If the speed had been 10 mi/hr faster, the travel time would have been 2 hours less. Find the speed of the vehicle.