

MATH 107 Practice Test Questions

1. Factor  $x^2 + 5x + 6$ .
2. Use synthetic division to find the quotient and remainder when  $x^3 + 2x^2 + 1$  is divided by  $x - 1$ .
3. Add and simplify  $\frac{4}{x-1} + \frac{x}{x+2}$ .
4. Simplify  $\frac{(x^2y)^{\frac{1}{3}}(xy^3)^{\frac{2}{3}}}{(xy)^2}$  using exponent rules. Assume that  $x > 0$  and  $y > 0$ .
5. Solve  $\frac{2x}{x^2-4} = \frac{4}{x^2-4} - \frac{3}{x+2}$ .
6. Find the real solutions, if any, of  $x^2 + x = 4$ . Use any method.
7. Find the real solutions of  $2x^{\frac{2}{3}} - 5x^{\frac{1}{3}} - 3 = 0$ .
8. Solve  $4 - 3x \leq 2$  and express your answer in interval notation. Graph the solution on the real number line.
9. Find all the points on the  $y$ -axis that are 5 units from the point  $(-4, 3)$ .
10. List the intercepts of  $y^2 = x + 9$ , and test for symmetry.
11. Find the slope-intercept equation of the line that is parallel to  $x - 2y = 3$  and contains the point  $(1, 2)$ .
12. Find the standard form of the equation of the circle centered at  $(1, 0)$  and containing the point  $(-3, 2)$ .
13. Graph the ellipse defined by the equation

$$\frac{(x+4)^2}{4} + \frac{(y-2)^2}{25} = 1.$$

Label the centre and 4 points on the ellipse.

14. Let  $f(x) = 3x^2 + 1$ , and let  $h \neq 0$  be a constant. Find and simplify

$$\frac{f(x+h) - f(x)}{h}.$$

15. Let  $f(x) = \frac{x^2 - 1}{x^2 - x - 2}$ . Find the  $x$ -intercept(s) and  $y$ -intercept of  $f$ .
16. Sketch the graph of a function that is increasing on  $(-\infty, 1)$  and decreasing on  $(1, \infty)$ . You do not need to give the equation of the function.
17. Let
- $$f(x) = \begin{cases} x + 1 & x < 0 \\ \sqrt{x} & x \geq 0 \end{cases}.$$
- a) Find  $f(-1)$ ,  $f(0)$ , and  $f(1)$ .
- b) Graph  $f$ .
18. Use transformations to graph  $f(x) = (x + 2)^3 - 1$ . Label at least 3 points on the graph.
19. Let  $(x, f(x))$  be a point on the graph of  $f(x) = x^2 - 1$ . Express the distance  $d$  from  $(x, f(x))$  to  $(0, 0)$  as a function of  $x$ .
20. Graph  $f(x) = 3x - 2$  and  $g(x) = -x + 1$  on the same plane and label the point that represents the solution to the equation  $f(x) = g(x)$ .
21. Find the vertex of the graph of  $f(x) = -2x^2 + 12x$ . Does this point represent the maximum or the minimum value of the function?
22. A farmer with 2000 meters of fencing wants to enclose a rectangular plot of land.
- a) Express the area  $A$  of the rectangle as a function of its width  $w$ .
- b) What is the largest area that can be enclosed?
23. Solve  $x^2 < -x + 6$ .
24. Graph  $f(x) = 2(x - 1)^2(x - 3)(x + 1)$ . Label the  $x$ -intercepts and  $y$ -intercept.
25. Graph  $f(x) = \frac{3x + 5}{x - 6}$ . Label the asymptotes,  $x$ -intercepts, and  $y$ -intercept.
26. Solve  $\frac{(x - 2)(x + 2)}{x} \leq 0$ .
27. Find one rational zero of  $f(x) = 6x^4 - x^3 + 2x^2 - 4x - 3$ .
28. Let  $f(x) = \frac{1}{x}$  and  $g(x) = \frac{4x}{x - 2}$ .
- a) Find  $(f \circ g)(1)$ .
- b) Find the domain of  $(f \circ g)(x)$ .

29. Let  $f(x) = \frac{3x}{x-2}$ .
- Find  $f^{-1}(x)$ .
  - Find the domain and range of  $f(x)$ .
30. Graph  $f(x) = e^{-x} + 1$ .
31. Given that  $f^{-1}(x) = \ln(x-2)$ , find the range of  $f(x)$ .
32. Find the exact value of  $\ln e^{\sqrt{2}}$ .
33. Solve  $2 \log_4 x = 1$ .
34. How long does it take for an investment to double if it is invested at 10% compounded continuously?
35. The population of a colony of mosquitoes obeys the law of uninhibited growth.
- If there are 1000 mosquitoes initially and there are 1800 after 1 day, what is the size of the colony after 3 days?
  - How long is it until there are 10,000 mosquitoes?
36. Convert  $\frac{5\pi}{6}$  radians to degrees.
37. Find the exact value of:
- $2 \sin 45^\circ + 4 \cos 30^\circ$
  - $\sec \frac{\pi}{4} + 2 \csc \frac{\pi}{3}$
38. Find the exact values of all 6 trigonometric functions of  $\theta = \frac{\pi}{4}$ . (Remember to rationalize denominators.)
39. Find the exact value of  $\sec 300^\circ$ .
40.  $\sin \theta = -\frac{3}{5}$  and  $\theta$  is in Quadrant IV. Find the exact values of  $\cos \theta$  and  $\tan \theta$ .
41. Graph  $f(\theta) = 2 \sin(\theta - \pi)$ . Label at least 6 points.
42. Graph  $f(\theta) = \tan \theta$ . Label at least 3 points and 3 asymptotes.
43. Graph  $f(\theta) = 3 \cos(3\theta - \pi)$ .
44. Find the exact value of  $\tan(\tan^{-1} 4)$ .
45. Establish the identity  $\cos^2 \theta(1 + \tan^2 \theta) = 1$ .

46. Find the exact value of  $\sin 15^\circ$ .

47. Establish the identity  $\cos^4 \theta - \sin^4 \theta = \cos(2\theta)$ .