Math 131- Winter 2025 – Review of Precalculus[1]

Cartesian Plane and Functions

1. Consider points $P(2,2)$ and $Q(3,-1)$. Find the midpoint of line segment $\overline{PQ}$.
2. Consider points $P(2,1)$ and $Q(5,-1)$. Find distance between P and Q.
3. Determine whether function $f(x) = x^3 + 5x$ is even, odd, or neither. What can you tell about its graph?
4. Let $f(x) = x^2 - x + 2$ and $g(x) = x + 1$. Find $f \circ g$ and $g \circ f$ and their domains.
5. Find inverse of $f(x) = 4x - 3$.
6. Find inverse of $f(x) = (x-2)^3 + 4$.

Lines

7. Find equation of line that passes through points $P(3,4)$ and $Q(2,-1)$.
8. Find equation of line that passes through point $P(2,1)$ and has slope $m = 4$.
9. Find equation of line that passes through point $P(1,-1)$ and that is parallel to the line $y = 2x - 6$.
10. Find equation of line that passes through point $P(1,-1)$ and that is perpendicular to the line $y = 2x - 6$.
11. Consider lines $y = 4x - 7$ and $y = -x + 3$. Find their intersection.

Polynomials and Rational Functions

12. Find equation of the quadratic function whose graph passes through points $(2,0)$ and $(-1,0)$.
13. Find equation of the quadratic function whose graph passes through points $(0,2)$ and $(1,0)$.
14. Find vertex and axis of the parabola with equation $y = 2x^2 - 4x + 6$
15. If $f(x) = x^2 - 3x - 5$, find its vertex and axis and intercepts.
16. Find all zeros of $f(x) = x^3 - 2x^2 - 2x - 3$.
17. Find factors of $f(x) = 3x^3 - 13x^2 + 13x - 3$.
18. Find point of intersection of $y = x^3 - 4$ and $y = x^2 - 4x$.
19. Find point of intersection of $y = x^2 + 1$ and $y = 2x$.
20. Factorize polynomial $f(x) = x^3 - 2x^2 - 2x - 3$.
21. Find domain of $f(x) = \dfrac{x-4}{3x-7}$.
22. Find all zeros of $f(x) = \dfrac{3x+5}{x^2-9}$.
23. Find vertical and horizontal asymptotes of $f(x) = \dfrac{x+3}{2x-6}$.
24. Find vertical and horizontal asymptotes of $f(x) = \dfrac{x+3}{x^2-2x-3}$.
25. Give an example of a rational function whose graph has vertical asymptote: $x = 1$ and horizontal asymptote: $y = 2$

[1] Some of these problems were inspired from problems given in Precalculus by R. Larson, 11th Edition, Cengage (2022)

Inequalities

26. Find all real numbers x satisfying the inequality.

$$|2x - 4| \leq 20$$

Give answer in interval form.

27. Find all x satisfying following inequality. Give answer in interval form.

$$|x - 2| < 3$$

28. Find all x satisfying following inequality. Give answer in interval form.

$$|x^2 - 2| < 5$$

29. Find solution set of $3x - 6 \leq 0$. Give answer in interval form.
30. Find solution set of $3x - 6 \leq 4x - 3$. Give answer in interval form.
31. Let $f(x) = x^2 - 4x$. Find all points for which $f(x) \leq 0$. Give answer in interval form.
32. Let $f(x) = x^2 - 2x$ and $g(x) = 2x - 6$. Find solution set of $f(x) > g(x)$. Give answer in interval form.

Exponential and Logarithmic Functions

33. Find all solutions of $4 + 3^{-x} = 31$.
34. Find domain of $f(x) = 4^x + x^4$
35. Solve $4^{x^2-4} = 64$
36. Find domain of $f(x) = \log(2x - 2)$
37. Solve $\log_3(x^2 - 3x - 3) = 0$
38. Simplify $\log_3(81) - 5\log_6 36$
39. Simplify $2\ln(3x) - \ln(4x^2y)$

Trigonometry

40. Convert $\theta = 5\pi/3$ to degrees.
41. Find reference angle of $\theta = 3\pi/4$.
42. Find value of $\sin(\frac{\pi}{3})$.
43. Find value of $\sin 45^\circ + \cos 45^\circ$.
44. Find value of $\sin 150^\circ$.
45. Find value of $\tan(\frac{2\pi}{3})$.
46. Find value of $\cos(\frac{7\pi}{4})$.
47. Simplify $\cos x \tan^2 x + \cos x$
48. Show that $\cos x \tan x + \sin x \tan^2 x = \sin x \sec^2 x$.
49. Solve $4\sin x + 3 = 5$
50. Solve $\sin^2 x \cos x + \cos^3 x = \dfrac{1}{2}$