2024 Precalculus Exam

1. For the following expression, for what value of b will result in a real solution?

$$(3+5i)^2+(7-bi)(4-2i)$$

(a) $b=3$ (b) $b=-2$ (c) $b=5$ (d) $b=4$
(e) None of the Above

2. Solve for a

$$\begin{bmatrix}3&5&7\\8&4&2\\9&1&3\end{bmatrix}\begin{bmatrix}8&3&2\\4&2&7\\6&2&5\end{bmatrix}=\begin{bmatrix}86&33&76\\92&a&54\\94&35&40\end{bmatrix}$$

(a) 36 (b) 64 (c) 34 (d) 72 (e) 48

3. What are the dimensions of the product matrix?

$$\begin{bmatrix}a&b&c&d\\e&f&g&h\\i&j&k&l\\m&n&o&p\end{bmatrix}\begin{bmatrix}q&r&s&t\\u&v&w&x\end{bmatrix}$$

(a) 4×4 (b) 4×2 (c) 2×4 (d) 2×2
(e) None of the above

4. Given the function $f(x)=\dfrac{\cos^2x-\sin^2x}{\cos^2x+\sin^2x}$. Simplify the function in terms of trigonometric functions

(a) $\cos^2x$ (b) $\cos^2x-\sin^2x$ (c) $\sin^2x$ (d) $\dfrac{\cos^2x-\sin^2x}{2}$

5. Given the function $g(x)=\dfrac{\sqrt{2x+5}}{x^2-4}$. Find the domain of the function.

(a) None of the below (b) $(-\infty,-\frac{5}{2})\cup(-2,2)\cup(2,\infty)$ (c) $(-\infty,\infty)$
(d) $\left[-\frac{5}{2},-2\right)\cup(-2,2)\cup(2,\infty)$

6. For the previous problem, for which values of x, does the graph of $g(x)$ have a vertical asymptote?

(a) $x=4$ (b) $x=-\frac{5}{2}$ (c) $x=-2,2$ (d) $x<-\frac{5}{2}$

7. $\sin(a)\cos(a)$ is equal to

(a) $\sin(2a)$ (b) $\frac{1}{2}\sin(2a)$ (c) $\sin^2(a)$ (d) $\tan(2a)$
(e) None of the above

8. What is the equation of a circle with the center $(2,1)$ and a diameter of 10?

(a) $(x-2)^2+(y-1)^2=5$ (b) $(x+2)^2+(y-1)^2=25$
(c) $(x+2)^2+(y+1)^2=25$ (d) $(x-2)^2+(y+1)^2=5$
(e) $(x-2)^2+(y-1)^2=25$

9. Which two binomials multiplied equal to $14x^2+22x-12$?

(a) $(2x+6)(7x-2)$ (b) $(7x-6)(2x+2)$
(c) $(7x+3)(2x-4)$ (d) $(2x+4)(7x-3)$
(e) None of the above

10. What is the simplified expression of $\sqrt{\dfrac{80x^8}{9x^6}}$

(a) $3x$ (b) $9x^2$ (c) $3x^2$ (d) x^2 (e) $9x$

11. Find the zeros of the function, $f(x) = x^n + x^{n-1} + x^{n-2} + x^n + \cdots + x$ where n is an even number, $n \geq 2$.

(a) $0, 1$ (b) $-1, 1$ (c) $-1, 0, 1$ (d) $-1, 0$
(e) None of the above

12. Simplify the complex expression $(5 + 3i)(1 + 3i)$.

(a) $4 - 18i$ (b) $6 + 9i$ (c) $6 - 9i$ (d) $18i - 4$
(e) None of the above

13. Solve for x.

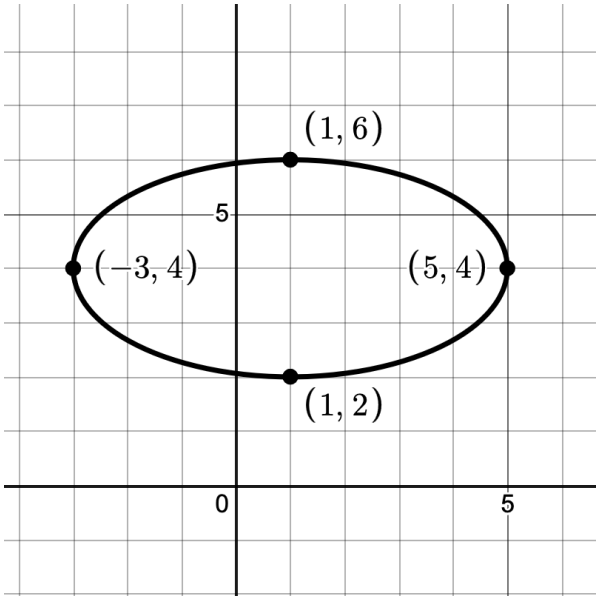
$$32^x = 4^{2x+2}$$

(a) -2 (b) 4 (c) $\frac{-16}{15}$ (d) 5
(e) None of the above

14. Given the vectors $\mathbf{u} = \langle 6, -2 \rangle$ and $\mathbf{v} = \langle 1, 8 \rangle$, solve for $4\mathbf{u} + 2\mathbf{v}$.

(a) $\langle 20, 8 \rangle$ (b) $\langle 26, 8 \rangle$ (c) $\langle 22, 24 \rangle$ (d) $\langle 12, 12 \rangle$
(e) None of the above

15. What is the equation of the ellipse provided below?



(a) $\frac{(x+1)^2}{16} + \frac{(y-4)^2}{4} = 1$ (b) $\frac{(x-1)^2}{16} + \frac{(y-4)^2}{4} = 1$
(c) $\frac{(x-1)^2}{16} + \frac{(y-4)^2}{4} = 1$ (d) $\frac{(x+1)^2}{16} + \frac{(y+4)^2}{4} = 1$
(e) None of the above

16. Find the partial fraction decomposition for the expression $\frac{12x}{x^2 - 1}$

(a) $\frac{6}{x+1} - \frac{6}{x-1}$ (b) $\frac{6}{x+1} + \frac{6}{x-1}$ (c) $\frac{4}{x-1} + \frac{3}{x-1}$ (d) $\frac{4}{x+1} + \frac{3}{x+1}$
(e) None of the above

17. Solve $(2^x + 3)(2^{-x} - 4) = 0$

(a) -1 (b) -2 (c) 1 (d) 2
(e) None of the above

18. Solve: $\log_8(x) = 2$

(a) $x = 4$ (b) $x = 16$ (c) $x = 32$ (d) $x = 64$
(e) None of the above

19. Simplify:

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

(a) $(x - 2)$ (b) $(x - 8)$ (c) $(x + 4)$ (d) $(x + 2)$

20. Solve for x:

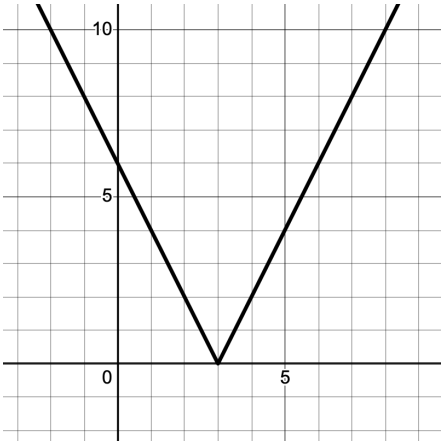
$$5^{6x} = 125^{7x-8}$$

(a) $x = 3.1$ (b) $x = 2.4$ (c) $x = 1.6$ (d) None of the above

21. In a right triangle ABC, with a right angle at B, $AC = 10$, and $BC = 6$. Solve for the value for $\sin(A)$, in it's simplest form.

(a) $\frac{6}{10}$ (b) $\frac{6}{5}$ (c) $\frac{3}{10}$ (d) $\frac{3}{5}$
(e) None of the above

22. Which function represents the graph below?



(a) $y = 2|x| - 3$ (b) $y = 2|x| - 6$ (c) $y = 2|x - 3|$ (d) $y = |2x - 3|$
(e) None of the above

23. Simplify the following expression.

$$\frac{6!}{4!2!}$$

(a) 1 (b) 15 (c) 30 (d) 20
(e) None of the above

24. Simplify:

$$\sqrt{x^9}\sqrt{x^4}$$

(a) $x^{\frac{13}{2}}$ (b) $x^{\frac{9}{4}}$ (c) x^6 (d) $x^3 \times x^2$
(e) None of the above

25. Is the function $f(x) = 2x^3 + 3x^2 - 12x$ odd, even, or neither?

(a) odd (b) even (c) both (d) neither

26. Which of the following is a root to the function $f(t) = t^{\frac{5}{3}} - 7t^{\frac{4}{3}} - 8t$.

(a) $t = 100$ (b) $t = 6$ (c) $t = 1$ (d) $t = 500$ (e) $t = -1$

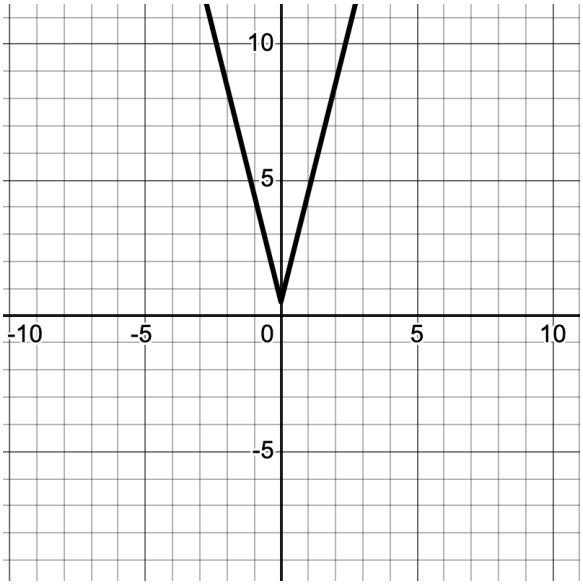
27. What is the range of the function $h(y) = -3\sqrt{14+3y}$.

(a) $(-\infty, 0)$ (b) $(-\infty, 0]$ (c) $(0, \infty]$ (d) $[-\infty, \infty]$
(e) None of the above

28. Find the vertical asymptotes of the function $f(x) = \dfrac{\sqrt{9x^2+3}}{4x-1}$

(a) $x = \dfrac{3}{4}$ (b) $x = \dfrac{1}{4}$ (c) $x = -\dfrac{1}{4}$ (d) None of the above

29. Which of the following best represents the graph shown below?



(a) $|\frac{1}{2}x| + 2$ (b) $|x| - 1$ (c) $|2x| + \frac{1}{2}$ (d) $|4x| + \frac{1}{2}$
(e) None of the above

30. Find $(f \circ g)(x)$.

$$f(x) = 2x^2 + 6x + 9, \quad g(x) = 4x + 3$$

(a) $32x^2 + 72x + 45$ (b) $8x^2 + 24x + 39$ (c) $16x + 15$
(d) $8x^4 + 48x^3 + 156x^2 + 252x + 225$ (e) None of the above

31. A water park wants to construct a new straight line water slide that starts 15 ft above ground level. If the angle of elevation is 35°, how long is the water slide?

(a) $15\tan(35°)$ (b) $15\cos(35°)$ (c) $\dfrac{15}{\sin(35°)}$ (d) $\dfrac{15}{\cos(35°)}$
(e) None of the above

32. Find the vertex (x, y) for a parabola with equation

$$y = 3x^2 - 6x + 1$$

(a) (2,1) (b) (1,-2) (c) (2,3) (d) (1,3)
(e) None of the above

33. Solve for x:

$$16^{5x} = 64^{7x+11}$$

(a) $x = -3$ (b) $x = 3.3$ (c) $x = 4.9$ (d) $x = 4.1$
(e) None of the above

34. What is $\sin^{-1}(\sin(5\pi/4))$?

(a) $\pi/4$ (b) $-\pi/4$ (c) $3\pi/4$ (d) $5\pi/4$
(e) None of the above

35. What are the asymptotes of the function

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

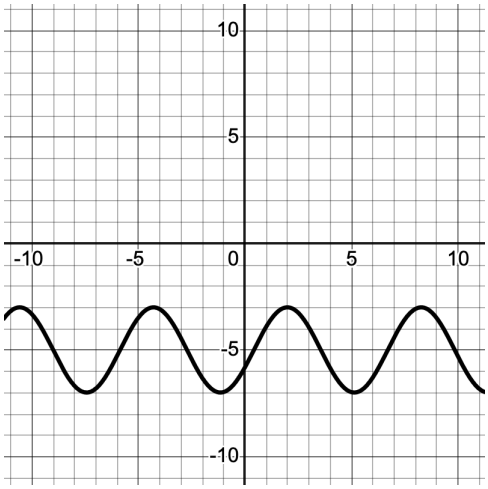
(a) $x = -1$, $x = 1$ and $y = 0$ (b) $y = -1$, $y = 1$ and $x = 0$ (c) $x = 0, 1, -1$
(d) $y = 0, -1, 1$ (e) None of the above

36. Given the piecewise function $f(x)$, evaluate $f(-8)$

$$f(x) = \begin{cases} x^2 - 15 & x < -4 \\ 5x + 7 & x \geq -4 \end{cases}$$

(a) -79 (b) -33 (c) 47 (d) 49
(e) None of the above

37. What is the equation of the function graphed below?



(a) $y = 2\cos(x-2) - 5$ (b) $y = \cos(x+2) - 5$
(c) $y = \frac{1}{2}\cos(x+2) - 5$ (d) $y = 2\cos(x+2) - 5$
(e) none of the above

38. A person wants to create a ramp to their truck to roll objects down. How long is the ramp if the door is 3 feet above ground at an angle of 43 degrees from the base of the ramp?

(a) $3\sin(43°)$ (b) $\frac{3}{\sin(43°)}$ (c) $\frac{3}{\cos(43°)}$ (d) $\frac{43}{\sin(3°)}$
(e) None of the above

39. Line AB passes through points $(-5, 8)$ and $(-3, 0)$. What is the point-slope equation for line CD if the line CD passes through point $(0, -1)$ and is perpendicular to line AB?

(a) $y = -4x - 12$ (b) $y = 4x - 12$ (c) $y = -\frac{1}{x} + 1$ (d) $y = \frac{1}{4}x - 1$
(e) None of the above

40. Find the simplest form of the function (restricted to its domain): $f(x) = \sin x \tan x - \sec x$.

(a) $\tan x$ (b) $-\csc x$ (c) $-\cos x$ (d) $\sin x$
(e) None of the above.