

TMATYC - Precalculus Test - 2016

1. For the function f , select the answer that best describes the behavior of f if for all a and b on an open interval I , $a < b$ implies that $f(a) > f(b)$.
 A. f is increasing over the interval I B. f oscillates over the interval I C. f is constant over the interval I
 D. f is decreasing over the interval I E. not enough information is given

2. For $f(x) = \frac{4}{x+1}$ and $g(x) = \frac{1}{x}$, find $\left(\frac{g}{f}\right)(x)$.
 A. $\frac{x+1}{4}$ B. $\frac{x+1}{4x}$ C. $\frac{4x}{x+1}$ D. $\frac{4}{x(x+1)}$ E. $4+x$

3. Find the exact distance between the points $(-3, 7)$ and $(2, 11)$.
 A. $\sqrt{41}$ B. $\sqrt{17}$ C. $(-\frac{1}{2}, 9)$ D. $5\sqrt{13}$ E. 17

4. Simplify the complex number $\frac{i}{2+i}$.
 A. $\frac{1}{2}$ B. $\frac{-1}{3+4i}$ C. $-\frac{1}{3} + \frac{2}{3}i$ D. $\frac{1}{5} + \frac{2}{5}i$ E. $\frac{2i-1}{5}$

5. Farmer Jim is obsessed with triangles. He decides to plant sausage trees in a triangular shape, but he wants to maximize the area he can plant. If the base and the height of his plot of trees must sum to 40 yards, what is the maximum area (in square yards) he can plant?
 A. 20 B. 400 C. 1600 D. 800 E. 200

6. As x approaches $-\infty$ and ∞ , respectively, the graph of the function $g(x) = -x^3 + x^5 - 0.5x^7$ approaches _____ and _____.
 A. $-\infty$ and $-\infty$ B. ∞ and ∞ C. ∞ and $-\infty$ D. $-\infty$ and ∞ E. ∞ and 0

7. Determine the horizontal and vertical asymptotes of $h(x) = \frac{x^3+6}{x^3+2x^2}$.
 A. there are no asymptotes B. $x = 0, x = -2, y = 1$ C. $x = 0, x = -2$
 D. $x = 2, y = -1$ E. $x = 0, x = 2, y = 1$

8. Solve $x^2 + x > 2$. Write the answer in interval notation.
 A. $(1, \infty)$ B. $(-2, 1)$ C. $(-\infty, -2) \cup (1, \infty)$ D. $[-2, 1]$ E. $(-\infty, -2] \cup [1, \infty)$

9. Solve $\frac{x^2-x-2}{x^2+5x+6} \leq 0$, expressing the answer in interval notation.
 A. $[-3, -2] \cup [-1, 2]$ B. $(-3, -2) \cup [-1, 2]$ C. $(-3, -2) \cup (-1, 2)$
 D. $(-\infty, -3) \cup (-2, -1) \cup (2, \infty)$ E. $[-3, -2] \cup (-1, 2)$

10. Express $\log_b\left(\frac{m^8}{a^3b^5}\right)$ in terms of sums and differences of logarithms, expanding as much as possible.

- A. $8\log_b m - 3\log_b a + 5$ B. $8\log_b m - 3\log_b a - 5\log_b b$ C. $8\log_b m - \log_b a^3 - 5\log_b b$
 D. $8\log_b m - 3\log_b a + 5\log_b b$ E. $8\log_b m - 3\log_b a - 5$

11. Express $2\log_m x + 4\log_m y - 3\log_m x$ as a single logarithmic term, simplifying where possible.

- A. $\log_m\left(\frac{8y}{3x}\right)$ B. $\log_m(x^2 + y^4 - x^3)$ C. $\log_m(x^5 y^4)$ D. $\log_m\left(\frac{y^4}{x}\right)$ E. $\log_m(xy^4)$

12. If $2^{2x-1} = 8^{-x}$ and $y = 15x + 2$, what is the product xy ?

- A. 1 B. $\frac{7}{3}$ C. 17 D. 5 E. undefined

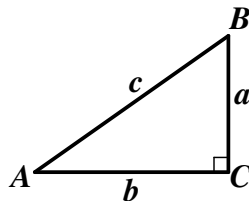
13. Solve $\log x + \log(x - 9) = 1$

- A. $x = 10$ B. $x = -1, 10$ C. $x = -1$ D. $x = 1, -10$ E. $x = 1$

14. Find a and b such that the function f is continuous if $f(x) = \begin{cases} -4 & \text{if } x \leq -3 \\ ax - b & \text{if } -3 < x < 1 \\ 2 & \text{if } x \geq 1 \end{cases}$

- A. $a = -3, b = 1$ B. $a = -\frac{3}{2}, b = \frac{1}{2}$ C. $a = \frac{3}{2}, b = -\frac{1}{2}$
 D. $a = 1, b = -3$ E. f is discontinuous for any a or b

15. Consider right triangle ABC shown below. What is the sum $a + c$, to the nearest inch, if $m\angle A = 35^\circ$ and $b = 40$ feet.



- A. 97 ft. 9 in. B. 76 ft. 10 in. C. 48 ft. 10 in. D. 28 ft. E. 25 ft. 4 in.

16. Find the reference angle θ_R and exact value of $\tan \theta$ for $\theta = -\frac{14\pi}{3}$.

- A. $\theta_R = -\frac{2\pi}{3}, \tan \theta = \sqrt{3}$ B. $\theta_R = \frac{\pi}{3}, \tan \theta = -\sqrt{3}$ C. $\theta_R = \frac{\pi}{3}, \tan \theta = \sqrt{3}$
 D. $\theta_R = \frac{4\pi}{3}, \tan \theta = -\sqrt{3}$ E. $\theta_R = \frac{2\pi}{3}, \tan \theta = \sqrt{3}$

17. Farmer Jim is replacing the weather vane on top of his grain silo when he notices his animals acting suspiciously. Upon closer inspection he notices that they are setting up a pumpkin launcher near the barn and taking aim in his direction. He estimates the angle of depression to the pumpkin launcher to be 53° and his height off the ground to be 30 meters. What is his slant distance to the pumpkin launcher? Round to the nearest tenth of a meter.
- A. 49.8 B. 22.6 C. 39.8 D. 37.6 E. 44.0
18. Find the real solutions to $x^{1/2} - 3x^{1/4} + 2 = 0$.
- A. $x = \frac{2}{3}$ B. there are no real solutions C. $x = \sqrt{2}$ D. $x = 1, 16$ E. $x = 1, -\frac{2}{3}$
19. Which exponential function(s) pass(es) through the data points $(-3, 2187)$ and $(6, \frac{1}{9})$?
- A. $y = 81(\frac{1}{3})^x$ B. $y = (\frac{1}{3})^{x-4}$ C. $y = 3^{4-x}$ D. none of A, B, or C E. all of A, B, and C
20. If $(t+a)(t+b)(t-3) = t^3 - 2t^2 - 5t + 6$, then $a + b =$
- A. 1 B. -1 C. -3 D. $1 \pm 2i$ E. no such a and b exist
21. In oblique triangle ABC , let the length of the side opposite angle A be a , the length of the side opposite angle B be b , and the length of the side opposite angle C be c . Given that $a = 4$, $b = 3$, and $m\angle B = 61^\circ$, find c to the nearest tenth, if possible.
- A. 5 B. 3.5 C. 2.6 D. 1.5 E. no such triangle exists
22. If a wheel rotates at 200 degrees per second, how fast is a point on the tire moving if it is 15 inches from the axle (center of wheel)? Express your answer to the nearest tenth of a foot per second.
- A. 3.9 B. 4.4 C. 52.4 D. 250.0 E. 3000.0
23. For the equation $\sqrt{x+1} + 3 = \sqrt{3x+4}$, let n be the number of real solutions. If x_1, x_2, \dots, x_n are the real solutions arranged in ascending order, what is $\frac{x_n}{n}$, the ratio of the largest solution to the number of solutions?
- A. -15 B. $-\frac{15}{2}$ C. $\frac{15}{2}$ D. 0 E. 15
24. If $f(x) = 1 - \frac{1}{2}x^3$, then $f^{-1}(x) =$
- A. $\sqrt[3]{2-2x}$ B. $\frac{2}{2-x^3}$ C. $\sqrt[3]{2}(1-x)$ D. $2\sqrt[3]{x} + 1$
- E. the function is not one-to-one and thus has no inverse
25. If $g(x) = 1 - f(x+2)$, then the graph of g is obtained by the following ordered sequence
- A. shifting f right by 2 units, up by 1 unit, and then reflecting across the x -axis
 B. shifting f right by 1 unit, down by 2 units, and then reflecting across the x -axis
 C. shifting f left by 2 units, up by 1 unit, and then reflecting across the x -axis
 D. shifting f by 2 units, reflecting across the y -axis, and then shifting up 1 unit.
 E. shifting f left by 2 units, reflecting across the x -axis, and then shifting up 1 unit.