

Precalculus
2012 Mu Alpha Theta Convention

Evaluate the expression.

1. $9^{\sqrt{3}}$

- [A] 44.957 [B] 140.296 [C] 0.022 [D] 15.588

2. $1500(2^{-2.3})$

- [A] 428.045 [B] -6900 [C] 304.595 [D] 7935

3. The population of an endangered animal species is given by

$$f(x) = 680(0.91)^t$$

where 680 is the number of animals currently in the population and t is the time in years. The population is decreasing at an annual rate of 9%. What is the estimated number of animals in this population in 5 years?

- [A] 374 [B] 466 [C] 424 [D] 619

4. If \$3000 is invested in a long-term trust fund with an interest rate of 6% compounded continuously, what is the amount of money in the account after 30 years?

- [A] \$18,148.94 [B] \$22,167.17 [C] \$17,230.47 [D] \$19,415.67

5. In 1995, the population of a country was estimated at 4 million. For any subsequent year the population $P(t)$ in millions is

$$P(t) = \frac{240}{5 + 54.99e^{-0.0208t}}$$

where t is the number of years since 1995. Use a graphing calculator to estimate the population in 2008.

- [A] 5,158,000 [B] 5,206,000 [C] 5,111,000 [D] 5,016,000

6. Use a calculator to evaluate the logarithm.

$$\log_{10} 67$$

- [A] 4.205 [B] 1.826 [C] 0.238 [D] 0.548

7. The time required for a particular medication to be eliminated from a person's bloodstream is

$$T = \frac{\ln m - \ln d}{\ln p}$$

where m is the amount of medication remaining in the bloodstream in milligrams, d is the original dose of medication in milligrams, and p is the fraction of medication still in the bloodstream each successive hour. If 85% of the medication remains in the bloodstream each hour after it is taken and the original dose was 240 mg, how long does it take until only 180 mg remain in the bloodstream?

- [A] 3.54 hours [B] 0.89 hour [C] 1.77 hours [D] 2.52 hours

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8. The time required to grow a certain bacteria in a culture beginning with 100 bacteria is

$$t = \frac{\ln B - \ln 100}{0.423}$$

where B is the number of bacteria and t is the time in hours. How much time is required to grow a culture of 4500 bacteria?

- [A] 5.3 hours [B] 3.8 hours [C] 9.0 hours [D] 4.4 hours

9. Evaluate the logarithm using the change-of-base formula.

$$\log_5 786$$

- [A] 33.335 [B] 2.912 [C] 1.333 [D] 4.142

10. Find the expression that is equivalent to the given logarithmic expression.

$$\log_b \sqrt{\frac{15}{67}}$$

- [A] $\log_b \frac{1}{2}(15 - 67)$ [B] $\frac{1}{2}(\log_b 15 + \log_b 67)$ [C] $\frac{1}{2}(\log_b 15 - \log_b 67)$ [D] $\sqrt{\log_b 15 - \log_b 67}$

11. Use the properties of logarithms to condense the logarithmic expression. $\log_2 38 + \log_2 30$

- [A] $\log_2 1140$ [B] $\log_2 68$ [C] $\log_2 38 \times \log_2 30$ [D] $\log_2 8$

Solve for x .

12. $\ln x - \ln 1 = 0$

- [A] $1e$ [B] e^1 [C] $\ln 1$ [D] 1

Solve for x .

13. $\frac{1}{8} = 4^{6x+2}$

- [A] $-\frac{5}{6}$ [B] $-\frac{7}{12}$ [C] $-\frac{5}{12}$ [D] $-\frac{1}{12}$

14. Find the conic section represented by the equation $9x^2 = 144 - 144y^2$.

- [A] Hyperbola [B] Ellipse [C] Circle [D] Parabola

15. Find the equations that represent circles.

(i) $5x^2 + 5y^2 + 5x + 2y + 16 = 0$

(ii) $30x^2 + 7y^2 + 4x + 12y - 25 = 0$

(iii) $13x^2 + 7y^2 + 3x - 9y - 9 = 0$

- [A] i and ii only [B] iii only [C] ii and iii only [D] i only

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22. Use the Rational Zero Test to determine all possible rational zeros of f . Do not find the actual zeros.

$$f(x) = 5x^3 + x^2 + 4x - 10$$

- [A] $\pm 2, \pm 5, \pm 10, \pm \frac{1}{5}, \pm \frac{2}{5}, \pm \frac{7}{5}$ [B] $0, \pm 1, \pm 2, \pm 5, \pm \frac{1}{5}, \pm \frac{2}{5}$
[C] $\pm 2, \pm 5, \pm 10, \pm 50, \pm \frac{1}{5}, \pm \frac{2}{5}$ [D] $\pm 1, \pm 2, \pm 5, \pm 10, \pm \frac{1}{5}, \pm \frac{2}{5}$

23. Use Descartes's rule of signs to determine the number of negative real zeros the polynomial function $f(x) = -3x^3 + x^2 + x - 1$ has.

- [A] 1 [B] 2 or 0 [C] 4, 2, or 0 [D] 5, 3, or 1

24. Simplify.

$$i^{54}$$

- [A] 1 [B] -1 [C] i [D] $-i$

25. Perform the indicated operation and write the result in standard form.

$$(-8 + 4i)(5 - 7i)$$

- [A] $-68 + 76i$ [B] $-12 - 76i$ [C] $-12 + 76i$ [D] $-68 + 36i$

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- [1] [A]
- [2] [C]
- [3] [C]
- [4] [A]
- [5] [C]
- [6] [B]
- [7] [C]
- [8] [C]
- [9] [D]
- [10] [C]
- [11] [A]
- [12] [D]
- [13] [B]
- [14] [B]
- [15] [D]
- [16] [C]
- [17] [D]
- [18] [A]
- [19] [D]
- [20] [C]
- [21] [C]
- [22] [D]
- [23] [A]
- [24] [B]
- [25] [C]