

## Practice Test 3

Name Solution

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

- 1) The formula  $P = 14.7e^{-0.21x}$  gives the average atmospheric pressure,  $P$ , in pounds per square inch, at an altitude  $x$ , in miles above sea level. Find the average atmospheric pressure for an altitude of 2.3 miles. Round your answer to the nearest tenth.

A) 9.1 lb/in.<sup>2</sup>

B) 7.8 lb/in.<sup>2</sup>

C) 8.4 lb/in.<sup>2</sup>

D) 11.0 lb/in.<sup>2</sup>

$$P = 14.7 e^{-0.21(2.3)}$$

1) A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the equation.

2)  $4^{1+2x} = 1024$

$$\ln 4^{(1+2x)} = \ln 1024$$

$$\begin{aligned} 1+2x &= 5 \\ 4 &= 4 \rightarrow 1+2x=5 \\ (1+2x) &= \frac{\ln 1024}{\ln 4} = 5 \rightarrow \end{aligned}$$

2) X=2

3)  $e^x - 6 = \left(\frac{1}{e^2}\right)^{x+4}$

$$e^{x-6} = e^{-2(x+4)} \rightarrow x-6 = -2x-8$$

3) X = -2/3

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

- 4) Three bacteria are placed in a petri dish. The population will triple every day. The formula for the number of bacteria in the dish on day  $t$  is

$$N(t) = 3(3)^t$$

where  $t$  is the number of days after the three bacteria are placed in the dish. How many bacteria are in the dish seven days after the three bacteria are placed in the dish?

A) 63

B) 1029

C) 6561

D) 13

$$N(7) = 3(3)^7 = 3^8$$

4) C

- 5) Find the amount in a savings account at the end of 5 years if the amount originally deposited is \$4000 and the interest rate is 7% compounded quarterly.

Use:  $A = P \left(1 + \frac{r}{n}\right)^{nt}$  where:

$A$  = final amount

$P$  = \$4000 (the initial deposit)

$r$  = 7% = 0.07 (the annual rate of interest)

$n$  = 4 (the number of times interest is compounded each year)

$t$  = 5 (the duration of the deposit in years)

A) \$5659.11

B) \$4362.47

C) \$81,400.00

D) \$6225.02

$$P = 4000$$

$$t = 5$$

$$\begin{aligned} r &= 0.07 \\ n &= 4 \end{aligned}$$

5) A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Change the exponential expression to an equivalent expression involving a logarithm.

6)  $9^x = 81$

$$a^x = y \leftrightarrow \log_a y = x$$

$$9^x = 81 \leftrightarrow \log_9 81 = x \quad \text{6) } \log_9 81 = x$$

$$\boxed{x=2}$$

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

7) The pH of a chemical solution is given by the formula

$$\text{pH} = -\log_{10}[\text{H}^+]$$

where  $[\text{H}^+]$  is the concentration of hydrogen ions in moles per liter.

Find the pH if the  $[\text{H}^+] = 1.5 \times 10^{-4}$ .

A) 4.82

B) 4.18

C) 3.82

D) 3.18

7)  $\boxed{C}$

$$\text{pH} = -\log 1.5 - \log 10^{-4}$$

$$\text{pH} = -\log 1.5 \times 10^{-4} = -\log 1.5 + 4 \log 10 = -\log 1.5 + 4$$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Find the domain of the function.

8)  $f(x) = \log_{10}(x^2 - 12x + 32)$

$$x^2 - 12x + 32 > 0 \quad (x-8)(x-4) > 0$$

$$\begin{array}{c} + \quad - \quad + \\ \leftarrow \quad \quad \quad \rightarrow \\ 4 \quad \quad \quad 8 \end{array}$$

8)  $(-\infty, 4) \cup (8, \infty)$

Solve the equation.

9)  $\log_6(x-3) = 1$

$$\leftarrow \rightarrow 6^1 = x-3 \quad \therefore \boxed{x=9}$$

9)  $\boxed{x=9}$

10)  $\ln \sqrt{x+8} = 7$

$$\frac{1}{2} \ln(x+8) = 7 \quad ; \quad \ln(x+8) = 14 \quad \leftrightarrow \quad (x+8) = e^{14}$$

10)  $\boxed{x = e^{14} - 8}$

Find the value of the expression.

11) Let  $\log_b A = 3$  and  $\log_b B = -12$ . Find  $\log_b \frac{A}{B}$ .

$$\log_b \frac{A}{B} = \log_b A - \log_b B$$

$$3 - (-12)$$

11)  $\boxed{15}$

Solve the equation.

12)  $\log_3(x+2) + \log_3(x-4) = 3$

key  $\log_a x = y \leftrightarrow x = a^y$

$$\log_3(x+2)(x-4) = 3$$

$$x^2 - 2x - 8 = 27$$

$$x^2 - 2x - 35 = 0$$

$$(x-7)(x+5) = 0$$

$$x = 7, -5$$

12)  $\boxed{x=7}$

13)  $\log_a(x-7) - \log_a(x-2) = \log_a(x-4) - \log_a(x+12)$

$$\log_a \frac{x-7}{x-2} = \log_a \frac{x-4}{x+12}$$

13)  $\boxed{x = \frac{92}{11}}$

$$\frac{x-7}{x-2} = \frac{x-4}{x+12} \rightarrow x^2 + 5x - 84 = x^2 - 6x + 8$$

$$11x = 92$$



14)  $3(1+2x) = 243$

$\ln 3^{1+2x} = \ln 243 \rightarrow 1+2x = \frac{\ln 243}{\ln 3}$  14)  $X=2$

$X = \frac{1}{2} \left[ \frac{\ln 243}{\ln 3} - 1 \right]$   $3^{1+2x} = 3^5 \rightarrow 1+2x=5$

Solve the exponential equation. Express the solution set in terms of natural logarithms.

15)  $e^{4x} = 7$

$X = \frac{1}{2} \left[ \frac{\ln 243}{\ln 3} - 1 \right]$  15)  $X = \frac{\ln 7}{4}$

$4x = \ln 7 \rightarrow X = \frac{\ln 7}{4}$

16)  $4x+4 = 5^{2x+5}$

$X \ln 4 - 2x \ln 5 = 5 \ln 5 - 4 \ln 4$

16)

$(X+4) \ln 4 = (2x+5) \ln 5$   $X(\ln 4 - 2 \ln 5) = 5 \ln 5 - 4 \ln 4$

$X \ln 4 + 4 \ln 4 = 2x \ln 5 + 5 \ln 5$   $X = \frac{5 \ln 5 - 4 \ln 4}{\ln 4 - 2 \ln 5}$

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

- 17) Sandy manages a ceramics shop and uses a 750°F kiln to fire ceramic greenware. After turning off her kiln, she must wait until its temperature gauge reaches 180°F before opening it and removing the ceramic pieces. If room temperature is 80°F and the gauge reads 600°F in 13 minutes, how long must she wait before opening the kiln? Assume the kiln cools according to Newton's Law of Cooling:

17) \_\_\_\_\_

$U = T + (U_0 - T)e^{kt}$

(Round your answer to the nearest whole minute.)

A) 224 minutes

B) 72 minutes

C) 155 minutes

D) 98 minutes

$T = 80$

$U = 7$

$t = 13$

$600 = 80 + (750 - 80)e^{13k}$   $k = -$

$180 = 80 + (750 - 80)e^{kt}$

$\rightarrow t = \frac{1}{k} \ln \left( \frac{100}{570} \right)$

$e^{13k} = \frac{600 - 80}{750 - 80} = \frac{520}{670}$

$97.56 \approx 98 \text{ min}$

$13k = \ln \frac{52}{67}$

$t = 246 \text{ min}$

$k = \frac{1}{13} \ln \frac{52}{67} = -0.00706$   $-0.0195$