Math 1101 Test 3 Practice Problems

These problems are not intended to cover all possible test topics. These problems should serve as an activity in preparing for your test, but other study is required to fully prepare. These problems contain some multiple choice question, please consult with your instructor for particular details about your class test.

Rewrite the expression as the sum and/or difference of logarithms, without using exponents. Simplify if possible.

1) \( \log_{16} \frac{\sqrt[3]{11}}{y^2x} \)

Rewrite as a single logarithm.

2) \( \frac{1}{2} \log_2 x^4 + \frac{1}{4} \log_2 x^4 - \frac{1}{6} \log_2 x \)

A) \( \log_2 x^{17/6} \)  B) \( \log_2 x^{9/2} \)  C) \( \frac{7}{6} \log_2 x^8 \)  D) \( \log_2 x^7 \)

Solve the equation by hand. Give the exact answer and then an approximation rounded to the nearest thousandth.

3) \( 5(x - 1) = 23 \)

Solve the equation. Give an exact solution.

4) \( \log (x - 3) = 1 - \log x \)

A) 5  B) -5, 2  C) -5  D) -2, 5

Solve the problem.

5) The sales of a new model of notebook computer are approximated by: \( S(x) = 4000 - 14000e^{-x/9} \), where \( x \) represents the number of months the computer has been on the market and \( S \) represents sales in thousands of dollars. In how many months will the sales reach $1,500,000?
6) Assume the cost of a car is $27,000. With continuous compounding in effect, the cost of the car will increase according to the equation $C = 27,000e^{rt}$, where $r$ is the annual inflation rate and $t$ is the number of years. Find the number of years it would take to double the cost of the car at an annual inflation rate of 5.2%. Round the answer to the nearest hundredth.

A) 209.55 years  
B) 1.96 years  
C) 13.33 years  
D) 196.22 years

7) Find the exponential function $f$ that models this data. Round the coefficients to the nearest hundredth.

| x | 1 | 2 | 3 | 4 | y | 580 | 620 | 670 | 750 |

A) $f(x) = (1.09)(527.34)^x$  
B) $f(x) = (567.57)(0.17)^x$  
C) $f(x) = (527.34)(1.09)^x$  
D) $f(x) = (0.17)(567.57)^x$

Find the exponential function that satisfies the given conditions.

8) Initial mass = 22 g, decreasing at a rate of 3.1% per day
Solve the problem.

9) Find an exponential function that models the data below and use it to predict about how many books will have been read in the eighth grade.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number of Books Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>121</td>
</tr>
</tbody>
</table>

A) 3000  B) 1000  C) 2000  D) 500

10) Several years ago, a large city undertook a major effort to encourage carpooling in order to reduce traffic congestion. The accompanying table shows the number of carpoolers, in thousands, from 1995 to 2000. Use regression to obtain a function $f(x) = a + b \ln x$ that models the data, where $x = 1$ corresponds to 1995, $x = 2$ to 1996, and so on. Round the constants $a$ and $b$ to the nearest hundredth.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpoolers</td>
<td>3.9</td>
<td>8.1</td>
<td>10.3</td>
<td>11.8</td>
<td>12.6</td>
<td>13.2</td>
</tr>
</tbody>
</table>

A) $f(x) = 4.40 + 5.32 \ln x$  B) $f(x) = 4.33 + 5.17 \ln x$
C) $f(x) = 4.22 + 5.25 \ln x$  D) $f(x) = 4.29 + 5.14 \ln x$

Provide an appropriate response.

11) Select an appropriate type of modeling function for the data shown in the graph. Choose from exponential, logarithmic, and linear.

A) Linear  B) Logarithmic  C) Exponential
12) Does it appear that a linear model or an exponential model is the better fit for the data given in the table below? Explain your choice.

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>7.5</td>
</tr>
<tr>
<td>6</td>
<td>9.8</td>
</tr>
<tr>
<td>8</td>
<td>12.3</td>
</tr>
</tbody>
</table>

Solve the problem.

13) Jorge invested $2500 at 4% compounded semiannually. In how many years will Jorge's investment have tripled? Round your answer to the nearest tenth of a year.

State whether the leading coefficient is positive or negative.

14)

A) 4: Leading coefficient is negative.  B) 3: Leading coefficient is negative.
C) 4: Leading coefficient is positive.  D) 3: Leading coefficient is positive.

State the degree and leading coefficient of the polynomial function.

15) \( f(x) = -2(x + 9)^2(x - 9)^2 \)

A) Degree: 4; leading coefficient: 1  B) Degree: 4; leading coefficient: -2
C) Degree: 2; leading coefficient: -2  D) Degree: 2; leading coefficient: 1

Predict the end behavior of the graph of the function.

16) \( f(x) = -1.48x^4 - x^3 + x^2 - 8x + 4 \)

A) Down on both sides  B) Up on both sides
C) Up on left side, down on right side  D) Down on left side, up on right side
Solve the problem.

17) \( P(x) = -x^3 + \frac{27}{2}x^2 - 60x + 100, \ x \geq 5 \) is an approximation to the total profit (in thousands of dollars) from the sale of \( x \) hundred thousand tires. Find the number of hundred thousands of tires that must be sold to maximize profit.

A) 5.5 hundred thousand  
B) 4 hundred thousand  
C) 5 hundred thousand  
D) 4.5 hundred thousand

Approximate the coordinates of each turning point accurate to two decimal places by using the appropriate Mathcad tool.

18) \( y = x^4 - 4x^3 + 4x + 6 \)

Solve the problem.

19) The table below gives the number of births, in thousands, to females over the age of 35 for a particular state every two years from 1970 to 1986.

<table>
<thead>
<tr>
<th>Year (thousands)</th>
<th>Births (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>42.5</td>
</tr>
<tr>
<td>1972</td>
<td>29.9</td>
</tr>
<tr>
<td>1974</td>
<td>36.0</td>
</tr>
<tr>
<td>1976</td>
<td>56.9</td>
</tr>
<tr>
<td>1978</td>
<td>71.1</td>
</tr>
<tr>
<td>1980</td>
<td>69.9</td>
</tr>
<tr>
<td>1982</td>
<td>57.2</td>
</tr>
<tr>
<td>1984</td>
<td>37.1</td>
</tr>
<tr>
<td>1986</td>
<td>25.9</td>
</tr>
</tbody>
</table>

Use technology to find the quartic function that is the best fit for this data, where \( x \) is the number of years after 1970. According to the model, how many births were there to females over the age of 35 in this state in 1990?

A) 108,868  
B) 106,368  
C) 101,318  
D) 94,368

Solve the polynomial equation by factoring.

20) \( x^3 - 8x^2 + 9x + 18 = 0 \)

A) -3, -6, 0  
B) -4, -7, 1  
C) 4, 7, -1  
D) 3, 6, -1
Solve the polynomial equation by using the root method.

21) \( \frac{1}{3}x^3 + 9 = 0 \)

Use the graph of the polynomial function \( f(x) \) to solve \( f(x) = 0 \).

22) 

A) -1, 0, 1, 2, 3  
B) -3, -2, -1, 1  
C) -3, -2, -1, 0, 1  
D) -1, 1, 2, 3

Solve the problem. Solve any equations using technology.

23) Photon Lighting Company determines that the supply and demand functions for its most popular lamp are as follows:

\[ S(p) = 400 - 4p + 0.00002p^4 \]
\[ D(p) = 2800 - 0.0012p^3, \] where \( p \) is the price. Determine the price for which the supply equals the demand.

A) $99.24  
B) $96.24  
C) $93.24  
D) $100.24