
True / False (?? points each). Record all answers on the cover page / answer sheet. There is no partial credit for this portion of the exam. Circle T if the statement is always true and circle F if the statement is sometimes false.

1. T F $(x + 2)^5 = x^5 + 32$
2. T F The lines $4x - 3y = 6$ and $3x + 4y = 29$ are perpendicular.
3. T F The linear cost function $C(x) = 100,000 + 1.5x$ has fixed costs 150.
4. T F The polynomial $y = x^3(x - 3)^2(x + 1)(x - 5)$ is a degree 7 polynomial which has roots only at $x = 0$, $x = 3$, $x = -1$, and $x = 5$.
5. T F The polynomial $y = x^5 + 4x^4 + 3x^2 + 15$ has two y -intercepts.
6. T F The rational function $f(x) = \frac{3x^2 + 2x - 5}{2x^2 - 15}$ has vertical asymptote $x = 0$.
7. T F The rational function $g(x) = \frac{4x^5 - 5x}{6x^6 - x^5}$ has horizontal asymptotes $y = 0$ and $y = 1$.
8. T F The function $f(x) = (.9)^x$ is an example of exponential decay.
9. T F A function is a rule that assigns to each input a unique output.
10. T F $\ln(ab) = (\ln a)(\ln b)$
11. T F $\ln a^b = b \ln a$
12. T F $\log_a b = \frac{\ln a}{\ln b}$
13. T F If the monthly loan payment is \$414.18 on a loan of \$35,000 and the first month the interest charged is \$215.86, then after the first payment, the amount still owed on the loan is \$34801.68.

Multiple Choice (?? points each). Record all answers on the cover page / answer sheet. There is no partial credit for this portion of the exam. Circle the letter corresponding to the best answer.

14. The line $x = 5$ has slope
- A. $m = 0$
 - B. $m = 1$
 - C. $m = 5$
 - D. slope is undefined
 - E. None of the above.
15. The equation of the line through $(-1, 3)$ perpendicular to the line through $(0, 1)$ and $(2, 3)$ is
- A. $y = x + 1$
 - B. $y = -x + 1$
 - C. $y = -x + 2$
 - D. $y = -x + 4$
 - E. none of the above
16. The graph of the quadratic function $f(x) = -6(x - 2)^2 - 5$
- A. has vertex $(2, -5)$ and opens down
 - B. has vertex $(2, -5)$ and opens up
 - C. has vertex $(-2, -5)$ and opens down
 - D. has vertex $(-2, -5)$ and opens up
 - E. None of the above.
17. $\log_4 16 =$
- A. 2
 - B. $\frac{1}{2}$
 - C. 4
 - D. -2
 - E. None of the above.
18. $\ln \frac{1}{e} =$
- A. -1
 - B. $-\frac{1}{2}$
 - C. $\frac{1}{2}$
 - D. 1
 - E. None of the above.

19. Find the linear cost function if the marginal cost is \$120, and 100 items cost \$15,800 to produce.
- A. $C(x) = 120x + 15,800$
 - B. $C(x) = 120x + 3800$
 - C. $C(x) = 3800x + 120$
 - D. $C(x) = 158x + 120$
 - E. none of the above

20. The owners of a parking lot have determined that their weekly revenue and cost in dollars are given by

$$R(x) = 125x$$

$$C(x) = 100x + 5000$$

where x is the number of long-term parkers. The break even point is

- A. 200 units
 - B. \$200
 - C. 0 units
 - D. \$25,000
 - E. none of the above
21. Which of the following is the quadratic function with vertex $(5, 6)$ that goes through the point $(1, 2)$?
- A. $f(x) = -\frac{1}{4}(x + 5)^2 + 6$
 - B. $f(x) = \frac{1}{4}(x - 5)^2 + 6$
 - C. $f(x) = -\frac{1}{4}(x - 5)^2 + 6$
 - D. $f(x) = -4(x - 5)^2 + 6$
 - E. none of the above

For the following **two** problems, consider the following rational function:

$$f(x) = \frac{x - 3}{x^2 - x - 2}$$

22. The vertical asymptote(s) are
- A. $x = -3$
 - B. $x = 3, x = 2, x = -1$
 - C. $x = 2, x = -1$
 - D. there are no vertical asymptotes
 - E. none of the above
23. The horizontal asymptote is
- A. $y = 0$
 - B. $y = 1$
 - C. $y = \frac{1}{2}$
 - D. there is no horizontal asymptote
 - E. none of the above
24. For the parabola, $f(x) = x^2 + 6x - 2$, the vertex is
- A. $(3, -11)$
 - B. $(-3, -11)$
 - C. $(3, 11)$
 - D. $(-3, 11)$
 - E. None of the above.
25. The effective rate after one year if \$1000 is invested in an account paying 6% compounded quarterly is
- A. 6%
 - B. 6.136%
 - C. 5.98%
 - D. 5.5%
 - E. None of the above.
26. A company has agreed to pay \$2.9 million in 5 years to settle a lawsuit. How much must they invest now in an account paying 8% compounded monthly to have that amount when it is due?
- A. \$2,805,236.99
 - B. \$28,639.98
 - C. \$1,946,510.29
 - D. \$1,973,691.27
 - E. None of the above.

27. A speculator agrees to pay \$15,000 for a parcel of land; this amount, with interest, will be paid over 4 years with semi-annual payments, at an interest rate of 10% compounded semiannually. What is the amount of each payment?
- A. \$2320.83
 - B. \$4230.18
 - C. \$2811.66
 - D. \$4732.06
 - E. None of the above.
28. You deposit \$1400 in an account at the end of each year. The account pays 8% interest compounded annually. After 8 years you have:
- A. \$14,891.29
 - B. \$11,200
 - C. \$8045.29
 - D. \$3691.29
 - E. None of the above.
29. John buys a house for \$249,900. He pays \$30,000 down and takes out a mortgage at 5.5% compounded monthly on the balance. Find the amount of interest he will pay on the loan if the length of the mortgage is 15 years.
- A. \$323,417.97
 - B. \$219,900
 - C. \$1796.77
 - D. \$103417.97
 - E. None of the above.
30. Bank A pays 6% interest compounded quarterly on investments. Bank B pays 6.24% interest compounded annually, and Bank C pays 5.8% interest compounded monthly. Which bank has the highest effective rate?
- A. Bank A
 - B. Bank B
 - C. Bank C
 - D. The effective rates are the same.
 - E. None of the above.
31. A typical pack-a-day smoker spends about \$100 per month on cigarettes. Suppose the smoker invests that amount at the end of each month in a savings account at 4.8% compounded monthly. What would the account be worth after 40 years?
- A. \$4328.41
 - B. \$96,872.14
 - C. \$328.41
 - D. \$144,872.14
 - E. None of the above

32. The system of linear equations

$$2x + 5y = 8$$

$$6x + 15y = 18$$

is

- A. independent
 - B. dependent
 - C. inconsistent
 - D. a baseball team
 - E. None of the above.
33. The system of linear equations

$$x + 2y + 4z = 6$$

$$y + z = 1$$

$$x + 3y + 5z = 10$$

- A. is inconsistent and therefore has no solutions.
 - B. is independent and has solutions $x = 2$, $y = 1$, $z = 0$.
 - C. is dependent and has solutions $x = 2$, $y = 1$, $z = 0$.
 - D. is dependent and has solutions $x = 2y$ and $z = y$.
 - E. None of the above.
34. A knitting shop ordered yarn from three suppliers I, II and III. One month the shop ordered a total of 100 units of yarn from these suppliers. The delivery costs were \$80, \$50, and \$65 per unit, respectively, with total delivery costs of \$5990. The shop ordered the same amount from suppliers I and II. How many units were ordered from each supplier?
- A. 22 units from suppliers I and II, and 56 units from supplier III.
 - B. 22 units from suppliers I and III, and 56 units from supplier II.
 - C. 22 units from suppliers II and III, and 56 units from supplier I.
 - D. no solutions
 - E. None of the above.

35. Solve the equation $\left(\frac{9}{16}\right)^x = \frac{3}{4}$

- A. $x = 2$
- B. $x = \frac{1}{2}$
- C. $x = -2$
- D. $x = -\frac{1}{2}$
- E. None of the above.

36. Solve the equation $8^p = 19$

A. $p = \frac{19}{8}$

B. $p = \frac{\ln 19}{\ln 8}$

C. $p = \frac{\ln 8}{\ln 19}$

D. no solutions

E. None of the above.

For the following two questions, consider the following situation:

The profit (in millions of dollars) from the sale of x million units of Blue Glue is given by $P(x) = .7x - 25.5$. The cost is given by $C(x) = .9x + 25.5$.

37. The revenue equation is:

A. $R(x) = 1.6x - 51$

B. $R(x) = 1.6x + 51$

C. $R(x) = 1.6x$

D. $R(x) = -.2x$

E. None of the above.

38. The break even point is

A. 36.428 units

B. \$36.43

C. 36,428,571 units

D. 36,428 units

E. None of the above.

Long Answer. Answer the following questions. No work = no credit. If you need to find the vertex of a quadratic function, show all steps necessary for completing the square.

39. Colleen Davis owns a factory that manufactures souvenir key chains. Her weekly profit (in hundreds of dollars) is given by

$$P(x) = -2x^2 + 60x - 120$$

where x is the number of cases of key chains sold.

- (a) (? points) Find the largest number of cases she can sell and still make a profit.
- (b) (? points) How many cases should she sell to maximize her profit?
40. (? points) Find the simple interest earned on an investment of \$4902 at 9.5% for 11 months.
41. (? points) If \$1288 is deposited in an account at the end of each year at 8% compounded annually, find when you would have \$31,188.82.
42. (? points) Find the amount of the payment necessary to amortize a loan of \$32,000 at 9.4% compounded quarterly to be repaid in 10 quarterly payments. How much is owed on the loan after the first payment is made?
43. (? points) Use the Gauss-Jordan method on the augmented matrix to solve the system of equations:

$$x + 2y + z = 0$$

$$y + 2z = 0$$

$$z + y - z = 0$$