

**PART 1:** Fill in the blanks with the answer. Do not show your work. Each question is worth 2 points each and no partial credit is given.

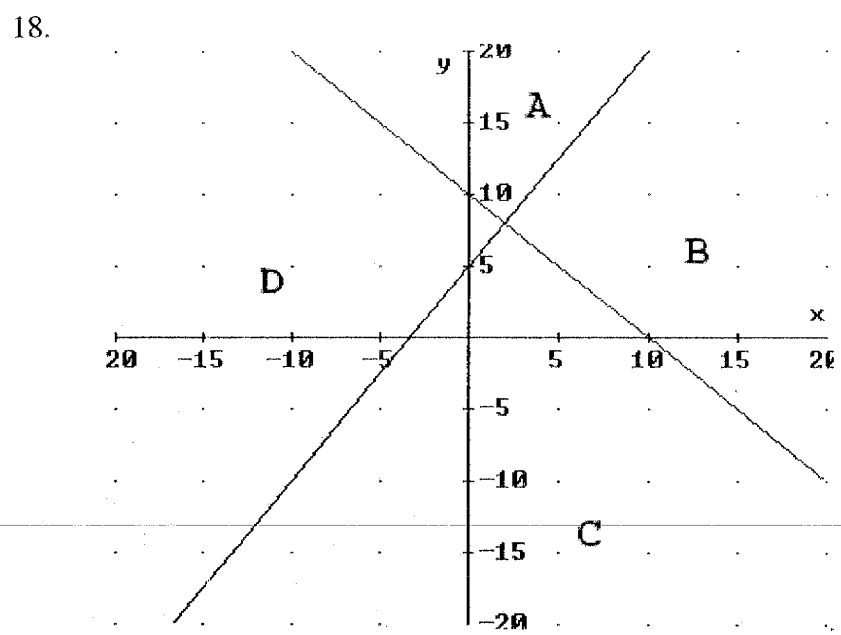
1. The equation of the line through the two points (2,-1) and (4,3) is  
 $y =$  \_\_\_\_\_
2. The vertex of the parabola described by  $y = -2x^2 + 4x + 1$  is  
( \_\_\_\_\_ , \_\_\_\_\_ )
3. The parabola  $y = -5x^2 + 2x + 9$  opens  
(circle one) up - down
4. The domain of the function  $y = \frac{x}{x^2 - 1}$  is  
\_\_\_\_\_
5. The equation(s) of the vertical asymptote(s) of  $y = \frac{x+2}{x^2 - 4}$  is (are)  
\_\_\_\_\_
6. If  $f(x) = x^2 + 1$  then  $f(x+1) =$  \_\_\_\_\_
7. If  $e^{3x} = 4$ , then the exact value of  $x$  is \_\_\_\_\_  
(Do not use your calculators)
8. Write as a single logarithm:  $3 \ln(x+2) - 4 \ln(x+1) = \ln(\text{_____})$
9. If \$100 is borrowed for 30 days with simple interest of 12%, how much interest is owed? (Use 360 days/yr) \_\_\_\_\_
10. For an annuity, if  $i = 0.01$ ,  $\text{Pmt} = \$100$ ,  $n = 5$ , then  $\text{PV} =$  \_\_\_\_\_
11. If \$100 is deposited in an account at 4% compounded monthly, the amount in the account after 5 months is \_\_\_\_\_
12. In an annuity, if  $i = 0.02$ ,  $n = 10$  and  $\text{PV} = \$13,000$ , then  $\text{Pmt} =$  \_\_\_\_\_
13. In an annuity, if  $i = 0.02$ ,  $\text{Pmt} = \$400$  and  $\text{FV} = \$13,000$ , then  $n =$  \_\_\_\_\_

14. The reduced row echelon form of  $\begin{bmatrix} 1 & 2 & 3 \\ -1 & 2 & 5 \\ 2 & 1 & 1 \end{bmatrix}$  is \_\_\_\_\_

15. If  $\begin{cases} 2x + 3y = 1 \\ 3x - 2y = 8 \end{cases}$  then  $x =$  \_\_\_\_\_ and  $y =$  \_\_\_\_\_

16.  $\begin{bmatrix} 1 & 3 \\ -1 & 4 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix} =$  \_\_\_\_\_

17. If the row reduced augmented matrix for a system of equations is  $\left[ \begin{array}{ccc|c} 1 & 2 & 0 & 1 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 0 \end{array} \right]$ , then the solution is  $x =$  \_\_\_\_\_,  $y =$  \_\_\_\_\_, and  $z =$  \_\_\_\_\_.



The region in the above graph that represents the solution to  $\begin{cases} y + x \leq 10 \\ 2y - 3x \geq 10 \end{cases}$  is (circle one): A - B - C - D

19. The corners of a bounded feasibility region are  $(x,y) = (0,0), (0,7), (3,4)$  and  $(4,0)$ . If the objective function is  $P = 5x + 2y$ , then the maximum value of  $P =$  \_\_\_\_\_

$$x + y \leq 8$$

20. List the corner points of the feasibility region of the system  $x + 2y \leq 10$ .

$$x, y \geq 0$$

Cornerpoints:  $(x,y) =$  \_\_\_\_\_

21. A sample space of equally likely elements is  $S = \{ a, b, c \}$ .

Then  $P(\{a\} \text{ or } \{b\}) =$  \_\_\_\_\_

In the last four problems, let  $P(A) = 0.7$ ,  $P(B) = 0.4$  and  $P(A \cap B) = 0.3$

22.  $P(A \cup B) =$  \_\_\_\_\_

23.  $P(A|B) =$  \_\_\_\_\_

24.  $P(B|A) =$  \_\_\_\_\_

25.  $A$  and  $B$  are (circle one): dependent - independent.

**PART 2:** Show all your work on the following application problems. If necessary, you may use the back of the page. Box your final answer for each part. Be neat. If the grader cannot read or understand your work, you will not get credit. Partial credit will be given if appropriate. Each problem is worth 10 points.

1. A company that manufactures and sells backpacks wants to market a new style of backpack. Manufacturing the new style will require a one-time (fixed cost) investment of \$900 for machinery, and a per-unit material cost (variable cost) of \$25. Moreover, market research has found that the price-demand function for the new backpack is  $p(x) = 145 - 3x$  where  $x$  is the quantity sold.

(a) Find cost function  $C(x)$ .

(b) Find the revenue function  $R(x)$

(c) Using (a) and (b), find the break-even points, where  $R(x) = C(x)$ .

(d) Find and graph the profit function, label at least two point on the graph, and find the maximum profit.

2. (a) Mary is planning for her retirement. For the next 25 years, she will deposit each month \$400 into an account earning 5% compounded monthly. How much money in total will she have in her account at the end of the 25 years? (Round to the nearest dollar)

(b) At the end of the 25 years, Mary will withdraw \$30,000 from her account and spend it traveling during the next three years. While she is gone, the money left in her account will continue to earn 6% compounded monthly. How much money will Mary have in her account when she gets back? (Round to the nearest dollar)

(c) After her three years of traveling, Mary wants to withdraw \$2,000 per month from her account for the next 25 years as her retirement income. During this time, her account will earn 6% compounded monthly. Will Mary have enough money to meet this goal? If not, how long can she withdraw the \$2000?

3. Your company has decided to purchase trucks that will consist of smaller trucks which can haul 20 tons and larger trucks which can haul 48 tons.

(a) If your company needs to haul 396 tons and you have decided to do it with exactly 10 trucks, how many trucks of each type should you purchase? If it is not possible, explain why.

(b) If your company needs to haul 550 tons and you have decided to do it with exactly 8 trucks, how many trucks of each type should you purchase? If it is not possible, explain why.

(c) If your company needs to haul 292 tons and you have decided to do it with exactly 9 trucks, how many trucks of each type should you purchase? If it is not possible, explain why.

4. A farmer wants to blend two brands of chicken feed to provide the necessary nutritional content at the least cost. Each pound of feed A provides 10g of iron, 10g of calcium, and 15000 calories; each pound of feed B provides 20g of iron, 10g of calcium, and 6000 calories. The minimum daily nutritional and caloric requirements for chickens are 80g of iron, 60g of calcium, and 45000 calories. If feed A costs \$0.40 per pound and feed B costs \$0.60 per pound, answer the following questions:

(a) Set up the linear programming problem

(b) Graph the above and shade the feasibility region

(d) List the corners and label them on the graph above.

(e) How many pounds of each brand should be used to make the least expensive blend?

(f) What is the minimum cost?

5. From a survey of 200 residents of a city, it was found that 80 read the daily morning paper, 140 read the daily evening paper, and 60 read both papers.

(a) Draw a Venn diagram to describe the reading habits of the people surveyed.

(b) What is the (empirical) probability that a resident reads at least one daily paper?

(c) What is the (empirical) probability that a resident does not read a daily paper?

(d) What is the (empirical) probability that a resident reads the daily evening paper, but does not read the daily morning paper?

(e) What is the (empirical) probability that a resident reads the daily morning paper given that the resident reads the daily evening paper?

## Facts and Formulas

### Algebra

$$a^x \cdot a^y = a^{x+y} \quad \frac{a^x}{a^y} = a^{x-y} \quad (a^x)^y = a^{xy} \quad \left(\frac{a}{b}\right)^x = \frac{a^x}{b^x} \quad (ab)^x = a^x b^x$$

$$a^x = a^y \text{ iff } x = y \quad a^x = b^x \text{ iff } a = b, x \neq 0$$

$$\log_b 1 = 0 \quad \log_b b = 1 \quad \log_b b^x = x \quad b^{\log_b x} = x \quad (x > 0)$$

$$\log_b(xy) = \log_b x + \log_b y \quad \log_b(x^n) = n \log_b x \quad \log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y \quad \log_b x = \log_b y \text{ iff } x = y$$

$$\text{Cost function: } C = (\text{fixed costs}) + (\text{variable costs}) = a + bx$$

$$\text{Price-demand: } p = m - nx$$

$$\text{Revenue function: } R = xp = x(m - nx)$$

$$\text{Profit function: } P = R - C = x(m - nx) - (a + bx)$$

### Finance

$$\text{Simple interest: } I = Prt$$

$$\text{Simple interest: } A = P(1 + rt)$$

$$\text{Compound interest: } A = P(1 + i)^n \text{ or } A = P\left(1 + \frac{r}{m}\right)^{mt}$$

$$\text{Continuous interest: } A = Pe^{rt}$$

$$\text{Annual percentage yield: } APY = \left(1 + \frac{r}{m}\right)^m - 1$$

$$\text{Future value ordinary annuity: } FV = PMT \frac{(1+i)^n - 1}{i}$$

$$\text{Present value ordinary annuity: } PV = PMT \frac{1 - (1+i)^{-n}}{i}$$

### Counting and Probability

$$\text{Permutations: } {}_n P_k = \frac{n!}{(n-k)!} \quad \text{Combinations: } {}_n C_k = \frac{n!}{(n-k)! k!}$$

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$