Answer Sheet for Part 1

You must transfer your answers to questions in Part 1 to this sheet.

Print your name and section _____

1. _____
2. _____
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22. _____
23. _____
24. _____
25. _____

Total points _____

Short Answer (2 points each)

Functions

1. $2\ln(x-4)+3\ln(x+2)=\ln($ _____ $)$.
2. The asymptotes, written as equations, of the function $f(x)=\frac{x-2}{x^2-3x-4}$ are

   horizontal asymptote: _____ and vertical asymptote(s): _____
3. The domain of $g(x)=\frac{x-2}{x^2-3x-4}$ is _____.
4. The equation of the line passing through the points $(1,2)$ and $(-1,4)$ is _____.
5. The vertex of the quadratic function $f(x)=-(x+2)^2-3$ is at _____.

Finance

6. If \$100 is borrowed for 6 months at 4% continuous interest, how much has to be paid at the end of the 6 months? _____
7. If \$1000 is invested at 4% compounded monthly, what is the amount after 5 years? _____
8. If \$1000 is deposited at the end of each quarter into a sinking fund that earns 6% compounded quarterly, how much will be in the account after 20 quarters? _____
9. What are the monthly payments for a 10-year loan at 6.2% compounded monthly for \$10,000? _____
10. How long will it take to pay off a loan of \$50,000 that earns 4.8% compounded monthly if you make payments of \$500? _____

Linear Systems

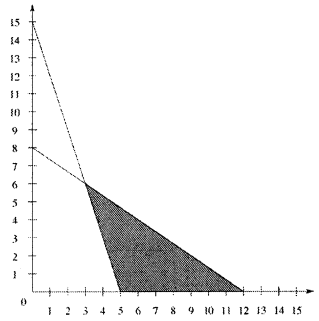
11. Let $A=\begin{bmatrix}x & 3 & m\end{bmatrix}$ and $C=\begin{bmatrix}2\\-1\\7\end{bmatrix}$, then the product $3AC=$ _____.
12. Let $B=\begin{bmatrix}-1 & 2\\2 & -3\end{bmatrix}$ and $G=\begin{bmatrix}1 & 2\end{bmatrix}$, then the product BG is _____.
13. Let $\begin{bmatrix}0 & n\\n & 3\end{bmatrix}+\begin{bmatrix}-1 & 2m\\m & 2\end{bmatrix}=\begin{bmatrix}-1 & 1\\-1 & 5\end{bmatrix}$, then $n=$ _____ and $m=$ _____.

14. Let $Q = \begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix}$, then $Q^{-1} =$ _____.

15. $\begin{bmatrix} 3 & -2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 20 \\ 10 \end{bmatrix}$, then $x_1 =$ _____ and $x_2 =$ _____.

Linear Programming

16. List the corner points of the system below: _____

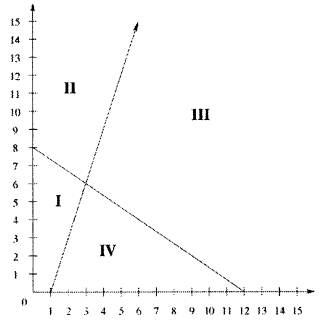


$$\begin{aligned} 2x_1 + 3x_2 &\leq 24 \\ 5x_1 + 2x_2 &\geq 30 \\ x_1, x_2 &\geq 0 \end{aligned}$$

17. The minimum value of $C = 5x_1 + x_2$ on the solution region in problem 16 is: _____

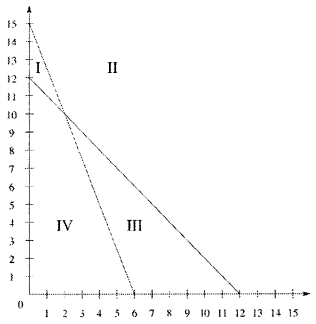
18. The maximum value of $C = 5x_1 + 6x_2$ on the solution region in problem 16 is: _____

19. Match the solution region of the following system of linear inequalities with one of the four regions shown in the figure: _____



$$\begin{aligned} 2x_1 + 3x_2 &\geq 24 \\ 2x_1 - x_2 &\leq 0 \\ x_1, x_2 &\geq 0 \end{aligned}$$

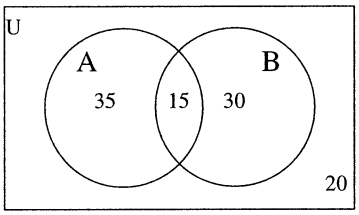
20. Match the solution region of the following system of linear inequalities with one of the four regions shown in the figure: _____



$$\begin{aligned} 2x_1 + 2x_2 &\leq 24 \\ 5x_1 + 2x_2 &\geq 30 \\ x_1, x_2 &\geq 0 \end{aligned}$$

Probability

21. Given the Venn diagram,



what is $P(A' \cap B)$? _____ $P((A \cup B)')$? _____

22. If P(A)=4/9, what are the odds for A? _____ against A? _____.

23. The probability that a sum of 7 turns up when rolling two fair dice is _____.

24. In a family with 3 children, the probability of having 2 girls and 1 boy is _____.

25. If a committee of 5 is chosen from 7 men and 4 women, what is the probability that the committee will have 3 men and 2 women? _____.

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Applications (10 points each, partial credit)

26. A small business makes and sells decorative vases. After some calculation they have determined that their cost function is $C(x) = 12x + 518$. As well, they have conducted a small survey to help them determine the relationship and demand, the results of which are given in the following table.

Price	Demand
\$ 80	10
\$ 20	40

(a) Using the above table, find the price-demand function, $p(x)$.

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

(c) Using the revenue and cost function find the break-even points, where $R(x) = C(x)$.

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

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27. Sue deposits $500 at the end of every quarter into a retirement annuity that earns 8.2% compounded quarterly. She does this for 20 years. She then leaves the money in the account earning interest but makes no more payments for the next 20 years at which time she retires.

    (a) How much will be in the account at the end of the 40 years? (Show ALL your work)

    (b) Jack decided to start his retirement annuity 20 years before he will retire. How much would he have to deposit at the end of every quarter into a retirement annuity that earns 8.2% compounded quarterly for a total of 20 years to have as much money in the account as Sue does when she retires?

    (c) Once they retire, how much can each of them withdraw from their retirement account at the end of each quarter if they want the account to last 30 years (at which time the account will have a zero balance)?

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28. A carpenter made three trips to the hardware store for a special kind of wood, some nails, and some screws. In the first trip he purchased 1 piece of wood, 1 bag of nails, and 3 bags of screws, for a total of $7.50. On the second trip he purchased 2 pieces of wood, 4 bags of nails, and 2 bags of screws, for a total of $14.00. On his final trip, he purchased 2 pieces of wood, 3 bags of nails, and 3 bags of screws, for a total of $13.50.

    (a) Define the problem variables.

    (b) Setup the system of equations.

    (c) Solve the system and write out your solution (i.e. give the price of each item).

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29. A garment company makes shirts and jeans. The production process includes cutting, sewing, and packaging. The company has 160 hours of cutting, 280 hours of sewing, and 98 hours of finishing available per day. The time requirements and profits per unit for the two garments are given in the following table.

	Hours			
Garment	cutting	sewing	finishing	profit ($)
Shirts	1	3.5	1	5.00
Jeans	4	4	2	6.40

(a) Set up the linear programming problem.

(b) Graph the above and shade the feasibility region.

(c) List the corner points and label them on the graph above.

(d) How many shirts and how many jean should be made to maximize profit?

(e) What is the maximum daily profit?

Print your name and section: _____

30. A company buys light bulbs from two different manufacturing plants, A and B. The company buys 65% of its light bulbs from plant A and 35% from plant B. Of the bulbs at plant A, 5% are defective; of those produced at plant B, 7% are defective.

    (a) Draw a probability tree to represent the data.

    (b) What is the probability that a bulb from plant A **is not** defective?

    (c) What is the probability that a bulb **is** defective?

    (d) What is the probability that a defective bulb came from plant B (i.e. probability the bulb was produced at plant B, given that it is defective)?

Facts and Formulas

Algebra

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

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

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

$$\log_b(xy) = \log_b x + \log_b y \qquad \log_b(x^n) = n \log_b x$$

$$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y \qquad \log_b x = \log_b y \text{ iff } x = y$$

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

Price–demand: $p = m - nx$

Revenue function: $R = xp = x(m - nx)$

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

Finance

Simple interest: $I = Prt$

$A = P(1 + rt)$

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

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

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

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

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

Counting and Probability

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

Permutations: ${}_n\text{P}_k = \dfrac{n!}{(n-k)!}$ Combinations: ${}_n\text{C}_k = \dfrac{n!}{(n-k)!k!}$

$$\text{P}(A|B) = \frac{P(A \cap B)}{P(B)} \qquad \text{P}(A \cap B) = \text{P}(A)\,\text{P}(B|A) = \text{P}(B)\,\text{P}(A|B)$$