

NAME Solutions SCORE: _____ / 110 = _____ %

Show steps and/or justify answers as indicated. You will not receive credit for answers without necessary justification.

[15] 1. The weekly demand for aspirin in a chain of drug stores is 2,400 bottles at a price of \$8.79 per bottle. If the price is lowered to \$7.89, the weekly demand increases to 2,715. Assume that the relationship between demand D and price per p is linear.

A. Write a linear equation that expresses D in terms of p .

$$(8.79, 2400) \text{ and } (7.89, 2715) \rightarrow m = -350 \text{ and } b = 5476.5$$

$$D = -350 p + 5476.5$$

B. What should the price of a bottle of aspirin be so that the demand is 3000 bottles?

$$3000 = -350p + 5476.5 \rightarrow p = 2476.5/350 = 7.08$$

$$\$7.08$$

C. How many bottles would the stores sell each week if the price is raised to \$9.29?

$$D = -350(9.29) + 5476.5 = 2225$$

D. Suppose that the Supply function for the mouthwash is $S = 400p$. Is there a surplus or shortage when the price is \$9.29? Explain.

$$S = 400(9.29) = 3716 > D = 2225$$

E. Find the equilibrium price.

$S = 400 p$ and $D = -350 p + 5476.5$ intersect at $(7.30, 2920.8)$. The equilibrium price is the x-coordinate, \$7.30.

F. For what prices is there a shortage? Explain.

A shortage occurs when demand exceeds supply. This condition occurs when $p < \$7.30$, the equilibrium price.

[10]2. The research department in a company that manufactures AM/FM clock radios established the following functions: Revenue: $R(x) = -1.25x^2 + 50x$ and Cost: $C(x) = 160 + 10x$, where x , $0 \leq x \leq 40$, is in thousands, and $R(x)$ and $C(x)$ are in thousands of dollars.

- A. Use your calculator to find the production level(s) of radios (to the nearest thousand) at which the company has break-even point(s). **Give units with your answer!!**

$$x \sim 4.68 \rightarrow 5,000 \text{ radios}$$

$$x \sim 27.31 \rightarrow 27,000 \text{ radios}$$

- B. If the company sells 20 thousand radios will they make a profit or experience a loss? Explain.

Yes, this amount of radios is in between the break even points.

$$\text{Or } R(20) = \$500 \text{ thousand} > C(20) = \$360 \text{ thousand}$$

3. A mortgage in the amount of \$520,000 is to be repaid in equal monthly payments at 7% interest compounded monthly.

- [8]** A. If the mortgage is for 30 years, find the amount of each monthly payment.

Using the TVM Solver:

N = 360
I% = 7
PV = 520,000
PMT = -3459.57
FV = 0
P/Y = 12
C/Y = 12

Answer: The monthly payment is: \$3459.57

- [2]** B. How much interest was paid on this mortgage over the 30 - year period? Show the steps in your calculation.

$$360(3,459.57) - 520,000 = \$725,445.20$$

- [8]** 4. The parents of a newborn baby are saving for college. They open an account and deposit \$150 into the account each month. If the account pays 4% interest compounded monthly, how much money will be in the account when the baby is 18 years old?

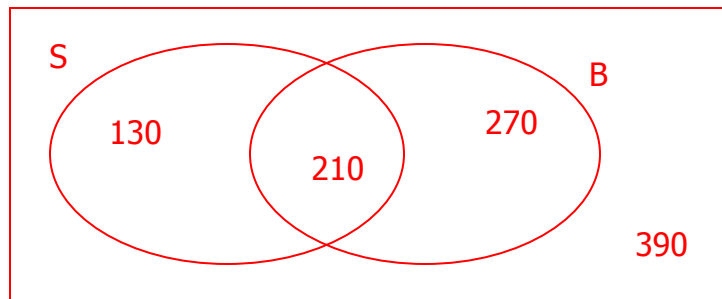
Using the TVM Solver:

N = 216
I% = 4
PV = 0
PMT = -150
FV = 47,338.87
P/Y = 12
C/Y = 12

Answer: \$47,338.87

- [10]** 5. A survey of 1,000 people indicates that 340 have invested in stocks, 480 have invested in bonds and 210 have invested in stocks and bonds.

A. Draw a two-set Venn diagram that illustrates this situation.



- B. How many people have invested in stocks or bonds? $130 + 210 + 270 = 610$
- C. How many people have invested in neither stocks nor bonds? 390
- D. How many people have invested in bonds but not stocks? 270

6. Analyze each sentence and translate the following problem into mathematical terminology by defining the variables, making a table, writing the objective function, and writing **all constraint inequalities**. (Do not graph the feasible region or finish the problem, just do the indicated parts.)

Wally's Warehouse sells trash compactors and microwaves. Trash compactors require 4 cubic feet of storage space and weigh 40 pounds. Microwaves require 3 cubic feet of storage space and weigh 77 pounds. Wally's storage space is limited to 120 cubic feet and a total of 8100 pounds for these items. The profit on a compactor is \$98 and on a microwave \$27. How many of each should Wally stock to maximize profit potential?

- [2] A. Define the variables for this problem.

$x =$ number of trash compactors

$y =$ number of microwaves

- [3] B. Make a table summarizing all of the data.

	Trash Compactors	Microwaves	limitations
Storage space	4	3	120
Weight	40	77	8100
Profit	98	27	

- [3] C. Write the objective function.

$$P = 98x + 27y$$

- [4] D. Write the system of **all inequalities** that must be satisfied to solve this problem.

$$4x + 3y \leq 120$$

$$40x + 77y \leq 8100$$

$$x \geq 0$$

$$y \geq 0$$

[6] 7. Use counting techniques to answer the following. Clearly show use of the multiplication principle, permutations, or combinations.

- A. A company has 200 employees. How many different ways can the employees be selected to win the 1st, 2nd, and 3rd prize at the company picnic?

$$P_{200,3} \text{ or } 200 (199) (198) = 7,880,400$$

- B. A restaurant offers ten entrees, three soups, five salads, and six desserts. How many different four-course meals can a person choose?

$$10 (3) (5) (6) = 900$$

- C. From a group of 60 employees how many ways can a group of five be chosen to attend a meeting?

$$C_{60,5} = 5,461,512$$

- [12] 8.** An electronics store received a shipment of 30 new calculators. There are six defective calculators in the shipment.

Your answers to parts B and C must be supported by showing your work.

- A. If one calculator is selected, what is the probability that it is defective?

$$6/30 = 1/5 = 0.2$$

- B. If three calculators are selected for display, what is the probability that all 3 of them are defective?

$$\frac{C_{6,3}}{C_{30,3}} = \frac{20}{4060} \text{ or } \frac{6}{30} \cdot \frac{5}{29} \cdot \frac{4}{28} = \frac{120}{24,360} = 0.0049$$

- C. If the original shipment of 30 calculators with 6 defective were representative of a larger batch of 2000 calculators, how many calculators would you expect to be defective in this larger batch of 2000.

$$(6/30)(2000) = 400 \text{ calculators}$$

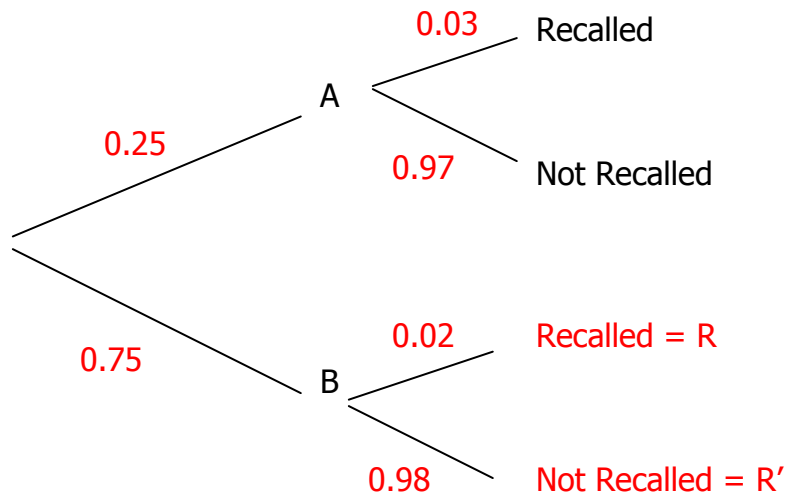
- [15]** 9. The following table contains the attendance data for a small theatre for the previous Saturday night.

Movie	Male (M)	Female (F)	Totals
(FF) Fast Five	800	400	1200
(S) Soul Surfer (S)	200	600	800
(T) Thor (3D)	900	500	1400
(W) Water for Elephants	150	900	1050
Totals	2050	2400	4450

- A. What is the probability that a person was a female and saw Water for Elephants? $P(F \cap W)$
- $900/4450$
- B. What is the probability that a person was a male or saw Fast Five? $P(M \cup FF)$
- $(2050 + 400)/4450 = 2450/4450$
- C. What is the probability that a person was a male given they saw Thor (3D)? $P(M|T)$
- $900/1440$
- D. What is the probability that a person saw Soul Surfer given they were female? $P(S|F)$
- $600/2400$
- E. What is the probability that a person was a female or did not see Thor(3D)? $P(F \cup T')$
- $(2400 + 2050 - 900)/4450 = (4450 - 900)/4450 = 3550/4450$

- [12]** 10. Companies A and B produce 25% and 75% respectively of the automobiles sold in a certain region. In that region, 3% of company A's cars and 2% of company B's cars have been recalled.

- A. Fill in the following probability tree.



- B. What is the probability that a car is both from company B **and** has been recalled? $P(B \cap R)$ Show work.

$$0.75(0.02) = 0.015$$

- C. What is the probability that a car has been recalled? $P(R)$ Show work.

$$0.75(0.02) + 0.25(0.03) = 0.015 + 0.0075 = 0.0225$$

- D. Suppose **it is known that** an automobile has been recalled. What is the probability that it was sold by Company B? $P(B | R)$ Show work.

$$P(B \cap R) / P(R) = 0.015 / 0.0225 = 0.67$$