

Please show all work neatly.

On each of the problems you must show the correct formula with correct numbers and appropriate units substituted into those formulas for a majority of the points. On the Venn diagram problem and the Tree diagram problem, you will receive the majority of the points for labeling each diagram correctly.

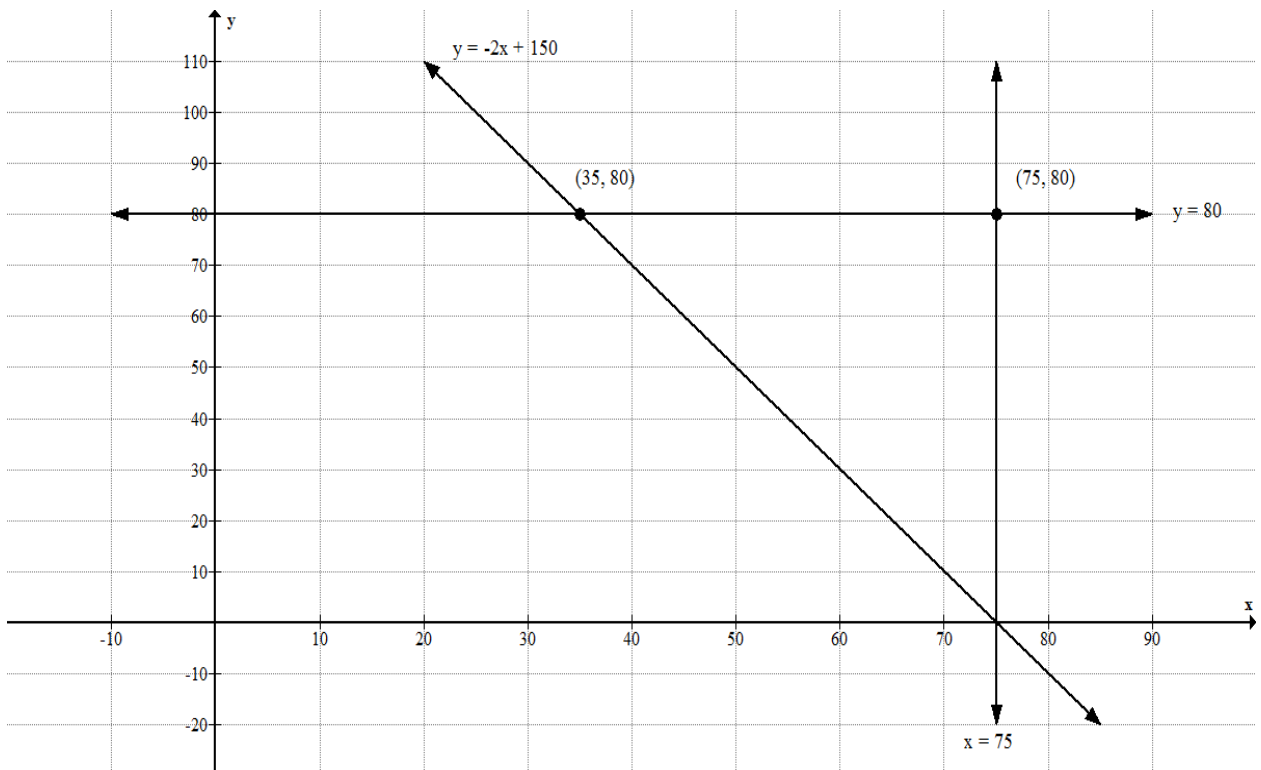
- (5 pts) 1. To produce x units of Solarbrush Drones it costs $C(x) = 12x + 39$. The revenue is $R(x) = 25x$. Both cost and revenue are in dollars.
- Find the break-even quantity.
 - Find the profit function.
 - Find the number of Drones that must be produced for a profit of \$170.

(15 pts) 2. A manufacturer of Flux 3D Printers must ship at least 100 Printers to its two West Coast Warehouses. Each Warehouse holds a maximum of 100 Printers, Warehouse A holds 25 Printers already, and Warehouse B has 20 on hand. It costs \$12 to ship a Printer to Warehouse A and \$10 to ship one to Warehouse B. Union rules require that at least 300 workers be hired. Shipping a Printer to Warehouse A requires 4 workers, while shipping a Printer to Warehouse B requires 2 workers.

- a. Complete the blank cells in the table with all appropriate data. Be sure to identify your variables.

	Warehouse A	Warehouse B	totals
Printers sent to both Warehouses	1		≥ 100
Printers needed by Warehouse A	1	0	≤ 75
Printers needed by Warehouse B	0		\leq
Workers required by union		2	≥ 300
Shipping cost		10	z

- b. Finish graphing the feasible region. Find and label all remaining lines of the feasible region. Find and label all remaining corner points and shade the feasible region.



- c. What is the objective function to minimize?
- d. Complete the Corner Point table.

Corner Points	
(35, 80)	1220
(75, 80)	1700

- e. How many Printers should be shipped to each warehouse to minimize costs?
- f. What is the minimum cost?

(15 pts) 3. The Texas Tech Forge produces and ships three different Double T plaques: a bronze plaque, a nickel plaque, and a pewter plaque. Each bronze plaque requires \$15 in materials, 5 hours of labor, and \$6 to ship. Each nickel plaque requires \$10 in materials, 4 hours of labor, and \$5 to ship. Each pewter plaque requires \$8 in materials, 4 hours of labor, and \$5 to deliver. The profit on the bronze plaque is \$15, on the nickel plaque is \$12, and on the pewter plaque is \$5. The company has available up to 2700 hours of labor per week. Each week, they can spend at most \$1500 on materials and \$1200 on shipping.

- a. Complete the following initial simplex tableau.

$$\begin{array}{ccccccc|c}
 x_1 & x_2 & x_3 & s_1 & s_2 & s_3 & z & \\
 \hline
 15 & & & 1 & 0 & 0 & 0 & 1500 \\
 & 4 & 4 & 0 & & 0 & 0 & \\
 6 & & 5 & & 0 & 1 & & 1200 \\
 \hline
 -15 & & & 0 & 0 & 0 & & 0
 \end{array}$$

- b. After one pivot, the simplex tableau is given below. Find the final simplex tableau. Be sure to show row operations as you learned in class.

x_1	x_2	x_3	s_1	s_2	s_3	z	
15	10	8	1	0	0	0	1500
0	2	4	-1	3	0	0	6600
0	5	9	-2	0	5	0	3000
0	-2	3	1	0	0	1	1500

- c. How many of each type of plaque should be made in order to maximize profit?

- d. What is the maximum profit?

- (4 pts) 4. An account invested in a money market fund grew from \$58,132 to \$58,965 in a month. What was the interest rate to the nearest tenth?
- (4 pts) 5. Using the rule of 70 or 72, estimate how long it would take for the general level of prices in the economy to double if the average annual inflation rate is given below. Round to the nearest year.
- | | |
|---------|---------|
| a. 3.9% | b. 5.6% |
|---------|---------|
- (5 pts) 6. In order to accumulate enough money for a down payment on a house, a couple deposits \$350 per month into an account paying 2.5% compounded monthly. If payments are made at the **end** of each month, how much money will be in the account in 4 years?
- (6 pts) 7. Gibbs deposits \$12,000 at the **beginning** of each year for 15 years in an account paying 5% compounded quarterly. He then puts the total amount on deposit in another account applying 11% compounded semiannually for another 13 years. Find the final amount on deposit after the entire 28-year period.

(4 pts) 8. James buys a car costing \$18,600. He makes a down payment of \$3,000. He agrees to make payments at the **end** of each monthly period for 5 years. He pays 8.3% interest, compounded monthly.

a. Find the amount of each payment.

b. Find the total amount of interest James will pay.

(7 pts) 9. A loan of \$6,000 at 12.25% interest compounded semi-annually is to be repaid in two years in equal semi-annual payments. The quarterly payment is \$1736.51. Complete the amortization schedule for the loan. Adjust the final payment so the balance is zero.

Payment Number	Amount of Payment	Interest Payment	Portion to Principal	End Principal
0				6000
1	1736.51			
2	1736.51	283.65	1452.86	3178.13
3	1736.51	194.66	1541.85	1636.28
4				

- (5 pts) 10. Find the half-life of a radioactive element, which decays according to the function

$$A(t) = A_0 e^{-0.0243t},$$

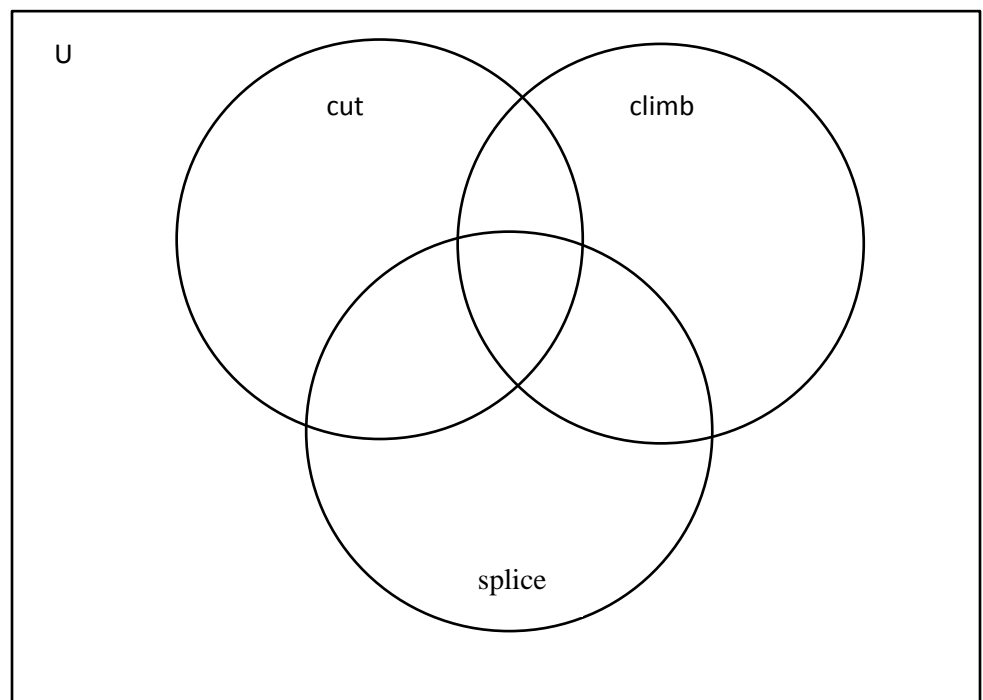
where t is the time in years. Round to the nearest year.

- (2 pts) 11. A comedian has 12 jokes. The comedian will be happy if the audience responds with howls of laughter to all 12 of his jokes. Of course, with audiences there are no guarantees. How many difference subsets of jokes may produce howls of laughter for the comedian?

(5 pts) 12. Jerry is a section chief for an electric utility company. The 160 employees in his section cut down trees, climb poles, and splice wire. Jerry reported the following information to the management of the utility.

- 45 can cut trees;
- 50 can climb poles;
- 57 can splice wire;
- 22 can climb poles and cut trees;
- 20 can climb poles and splice wire;
- 25 can cut trees and splice wire;
- 9 can do all three

a. Fill in the Venn diagram.



- b. How many employees can do two of these skills?
- c. How many employees can do only one of the skills?
- d. How many employees cannot splice?
- e. How many employees can do none and are therefore considered in training?

(2 pts) 13. The probability that a visit to a primary care physician's (PCP) office results in neither lab work nor referral to a specialist is 28%. Of those coming to a PCP's office, 35% are referred to specialists and 56% require lab work. Determine the probability that a visit to a PCP's office results in both lab work and referral to a specialist.

(3 pts) 14. An Othermill (milling machines for metal, wood, wax, or plastic) factory runs two assembly lines, A and B. 93% of line A's machines pass inspection and 89% of line B's machines pass inspection. 40% of the company's machines come off assembly line A and the rest come off line B. Find the probability that one of the company's machines did not pass inspection and came off assembly line A.

- (3 pts) 15. The information in the table given pertains to three warehouses operated by a certain corporation. Their internal auditor randomly selects one set of shipping documents and determines that the set selected contains an error. Find the probability that the error occurred in Warehouse A.

Warehouse	Percentage of Cargo Handled	Percent Error
A	60	2
B	30	8
C	10	12

- (5 pts) 16. A shipment of 10 sewing machines contains 3 that are defective. Find the probability that a sample of size 2, drawn from the 10, will not contain a defective machine. Round to three decimal places.

(5 pts) 17. A factory tests a random sample of 20 computers for defects. The probability that a particular computer will be defective has been established by past experience as 0.03. What is the probability that there are no defective computers in the sample? Round to four decimal places.

(5 pts) 18. A local car dealer gets complaints about his body shop work as shown in the table below. Find the expected number of complaints per day.

Number of Complaints per Day	0	1	2	3	4	5	6
Probability	0.02	0.06	0.16	0.25	0.32	0.13	0.06

Formulas

$$A = P(1 + rt) \quad \text{Future Value for Simple Interest}$$

$$A = P(1 + i)^n \quad \text{Compound Interest}$$

$$A = Pe^{rt} \quad \text{Compound Continuously}$$

$$r_E = \left(1 + \frac{r}{m}\right)^m - 1 \quad \text{Effective Rate, Compound}$$

$$r_E = e^r - 1, \quad \text{Effective Rate, Continuous}$$

$$\frac{70}{r} \quad \text{Rule of 70}$$

$$\frac{72}{r} \quad \text{Rule of 72}$$

$$S = R \left[\frac{(1+i)^n - 1}{i} \right] \quad \text{Future Value of Ordinary Annuity}$$

$$S = R \left[\frac{(1+i)^{n+1} - 1}{i} \right] - R \quad \text{Future Value of Annuity Due}$$

$$P = R \left[\frac{1 - (1+i)^{-n}}{i} \right] \quad \text{Present Value of an Ordinary Annuity}$$

$$i = \frac{r}{m} \quad n = mt$$

$$P(x) = C(n, x) p^x (1-p)^{n-x} \quad \text{Binomial Probability}$$