Linear programing problems worksheet

I'm not robot!

Literal Equations Worksheet Name _____

Solve for the indicated variable:

1. t: $D = rt$

2. s: $h = \frac{\sqrt{3}s}{2}$

3. h: $V = \frac{\pi r^2 h}{3}$

4. b_1: $A = \frac{1}{2}h(b_1 + b_2)$

5. R: $S = ns(R + r)$

6. w: $S = \frac{1}{2}(wh_1 + wh_2)$

7. r: $I = P(1 + rt)$

8. C: $F = \frac{9}{5}C + 32$

9. h: $S = 2\pi rh + 2\pi r^2$

10. r_2: $R(r_1 + r_2) = r_1 r_2$

Name _____ Period _____ Date _____

Algebra I – Unit 1 Take-home Test

FOR ALL TEST QUESTIONS, SHOW ALL WORK. CIRCLE YOUR FINAL ANSWERS

Evaluate the expression for the given value of the variable. (Lessons 1.1 and 1.2)

1) $b - 7$ when $b = 24$

2) $\frac{d}{12}$ when $d = 60$

3) $(2x)^3$ when $x = 3$

4) $\frac{1}{2} + t$ when $t = \frac{1}{2}$

5) $3x - 2$ when $x = 7$

6) $6 \cdot 2p^2$ when $p = 5$

Evaluate the expression. (Lesson 1.3)

7) $6 \div 3 + 2 \cdot 7$

8) $2[(7-4)^2 + 3] + 15$

9) $6(5-3)^2 + 3$

10) $\frac{13-4}{18-4^2+1}$

11) $[15 + (5^2 \cdot 2)] \div 13$

12) $\frac{(37-28)^2 - 6}{32 \div 2^2 - (4^2 - 13)}$

13) Is the following statement correct? Explain. (Lesson 1.3)

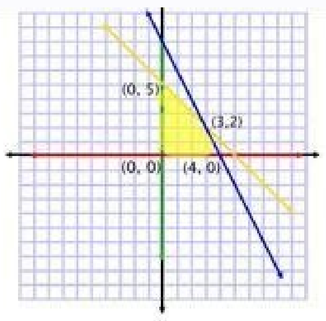
$$\frac{(9-7)^3 + 10}{5} = (9-7)^3 + 10 \div 5$$

$4x + 2y \leq 16$

$3x + 3y \leq 15$

$x \geq 0$

$y \geq 0$



Plug each of the vertices into the objective function:
P = 3x + 2y

The basic idea of linear programming says that in a case such as this, the maximum (or minimum) profit will be found at a corner of the graph. Remember we are looking for the maximum.

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Answer:

Linear Programming (Solutions)

C) A furniture store makes two types of chairs: rockers and swivels. Machines A an B are required to make each type of chair. Machine A can be run no longer than 20 hours in a day. Machine B is limited to 15 hours per day.

The following Table shows the time needed to produce each chair and the profit.

Chair	Machine A	Machine B	Profit
Rocker	2 hours	3 hours	$12
Swivel	4 hours	1 hour	$10

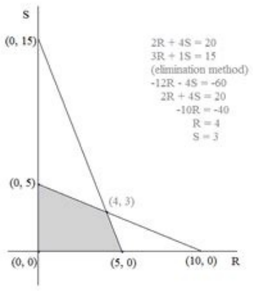
How many of each chair should be made each day to maximize profits?

1) Identify and label variables: R = # of rockers S = # of swivels

2) Determine the objective function: "how many to maximize profits?"

12R + 10S = Profit

3) List and graph the constraints: (time of machine use)
Machine A: $2R + 4S \leq 20$
Machine B: $3R + 1S \leq 15$



$2R + 4S = 20$
$3R + 1S = 15$
(elimination method)
$-12R - 4S = -60$
$2R + 4S = 20$
$-10R = -40$
$R = 4$
$S = 3$

4) Test the corner points of the feasibility region.

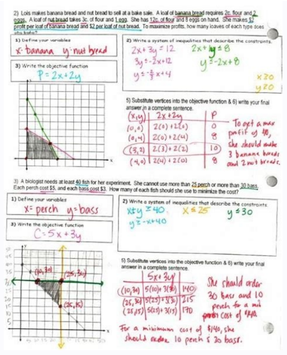
(0, 0) : 12(0) + 10(0) = 0

(0, 5) : 12(0) + 10(5) = 50

(4, 3) : 12(4) + 10(3) = 78

(5, 0) : 12(5) + 10(0) = 60

The furniture store should produce 4 rockers and 3 swivel chairs each day to maximize profits!



Linear programing word problems worksheet. What is linear programming examples. What is linear programming in excel.

Example 1 A store sells two types of toys, A and B. The store owner pays $8 and $14 for each one unit of toy A and B respectively. One unit of toys A yields a profit of $2 while a unit of toys B yields a profit of $3. The store owner estimates that no more than 2000 toys will be sold every month and he does not plan to invest more than $20,000 in inventory of these toys. How many units of each type of toys should be stocked in order to maximize his monthly total profit profit? Solution to Example 1 Let x be the total number of toys A and y the number of toys B; x and y cannot be negative, hence x ≥ 0 and y ≥ 0 The store owner estimates that no more than 2000 toys will be sold every month x + y ≤ 2000 One unit of toys A yields a profit of $2 while a unit of toys B yields a profit of $3, hence the total profit P is given by P = 2 x + 3 y The store owner pays $8 and $14 for each one unit of toy A and B respectively and he does not plan to invest more than $20,000 in inventory of these toys 8 x + 14 y ≤ 20,000 What do we have to solve? Find x and y so that P = 2 x + 3 y is maximum under the conditions \[\begin{cases} \ x \ge 0 \\ \ x \ge 0 \\ \ x + y \le 2000 \\ \ 8 x + 14 y \le 20,000 \\ \end{cases} \] The solution set of the system of inequalities given above and the vertices of the region obtained are shown below: . Vertices of the solution set: A at (0 , 0) B at (0 , 1429) C at (1333 , 667) D at (2000 , 0) Calculate the total profit P at each vertex P(A) = 2 (0) + 3 ()) = 0 P(B) = 2 (0) + 3 (1429) = 4287 P(C) = 2 (1333) + 3 (667) = 4667 P(D) = 2(2000) + 3(0) = 4000 The maximum profit is at vertex C with x = 1333 and y = 667. Hence the store owner has to have 1333 toys of type A and 667 toys of type B in order to maximize his profit. Example 2 A company produces two types of tables, T1 and T2. It takes 2 hours to produce the parts of one unit of T1, 1 hour to assemble and 2 hours to polish.It takes 4 hours to produce the parts of one unit of T2, 2.5 hour to assemble and 1.5 hours to polish. Per month, 7000 hours are available for producing the parts, 4000 hours for assembling the parts and 5500 hours for polishing the tables. The profit per unit of T1 is $90 and per unit of T2 is $110. How many of each type of tables should be produced in order to maximize the total monthly profit? Solution to Example 2 Let x be the number of tables of type T1 and y the number of tables of type T2. Profit P(x , y) = 90 x + 110 y \[\begin{cases} \ x \ge 0 \\ \ x \ge 0 \\ \ 2x + 4y \le 7000 \\ \ x + 2.5y \le 4000 \\ \ 2x + 1.5y \le 5500 \\ \end{cases} \] The solution set of the system of inequalities above and the vertices of the feasible solution set obtained are shown below: . Vertices: A at (0,0) B at (0,1600) C at (1500,1000) D at (2300,600) E at (2750,0) Evaluate profit P(x,y) at each vertex A at (0,0) : P(0 , 0) = 0 B at (0,1600) : P(0 , 1600) = 90 (0) + 110 (1600) = 176000 C at (1500,1000) : P(1500,1000) = 90 (1500) + 110 (1000) = 245000 D at (2300,600): P(2300,600) = 90 (2300) + 110 (600) = 273000 E at (2750,0) : P(2750,0) = 90 (2750) + 110 (0) = 247500 The maximum profit of $273000 is at vertex D. Hence the company needs to produce 2300 tables of type T1 and 600 tables of type T2 in order to maximize its profit. Example 3 A farmer plans to mix two types of food to make a mix of low cost feed for the animals in his farm. A bag of food A costs $10 and contains 40 units of proteins, 20 units of minerals and 10 units of vitamins. A bag of food B costs $12 and contains 30 units of proteins, 20 units of minerals and 30 units of vitamins. How many bags of food A and B should be consumed by the animals each day in order to meet the minimum daily requirements of 150 units of proteins, 90 units of minerals and 60 units of vitamins at a minimum cost? Solution to Example 3 Let x be the number of bags of food A and y the number of bags of food B. Cost C(x,y) = 10 x + 12 y \[\begin{cases} \ x \ge 0 \\ \ y \ge 0 \\ \ 40x + 30y \ge 150 \\ \ 20x + 20y \ge 90 \\ \ 10x + 30y \ge 60 \\ \end{cases} \] The solution set of the system of inequalities above and the vertices of the feasible solution set obtained are shown below: . Vertices: A at intersection of \(10x + 30y = 60 \) and \(y = 0 \) (x-axis) coordinates of A: (6 , 0) B at intersection of \(20x + 20y = 90 \) and \(10x + 30y = 60 \) coordinates of B: (15/4 , 3/4) C at intersection of \(40x + 30y = 150 \) and \(20x + 20y = 90 \) coordinates of C : (3/2 , 3) D at at intersection of \(40x + 30y = 150 \) and \(x = 0 \) (y-axis) coordinates of D: (0 , 5) Evaluate the cost c(x,y) = 10 x + 12 y at each one of the vertices A(x,y), B(x,y), C(x,y) and D(x,y). At A(6 , 0) : c(6 , 0) = 10 (6) + 12 (0) = 60 At B(15/4 , 3/4) : c(15/4 , 3/4) = 10 (15/4) + 12 (3/4) = 46.5 At C(3/2 , 3) : c(3/2 , 3) = 10 (3/2) + 12 (3) = 51 At D(0 , 5) : c(0 , 5) = 10 (0) + 12 (5) = 60 The cost c(x , y) is minimum at the vertex B(15/4 , 3/4) where x = 15/4 = 3.75 and y = 3/4 = 0.75. Hence 3.75 bags of food A and 0.75 bags of food B are needed to satisfy the minimum daily requirements in terms of proteins, minerals and vitamins at the lowest possible cost. Example 4 John has $20,000 to invest in three funds F1, F2 and F3. Fund F1 is offers a return of 2% and has a low risk. Fund F2 offers a return of 4% and has a medium risk. Fund F3 offers a return of 5% but has a high risk. To be on the safe side, John invests no more than $3000 in F3 and at least twice as much as in F1 than in F2. Assuming that the rates hold till the end of the year, what amounts should he invest in each fund in order to maximize the year end return? Solution to Example 4 Let x be the amount invested in F1, y the amount invested in F2 and z the amount invested in F1. x + y + z = 20,000 z = 20,000 - (x + y) Total return R of all three funds is given by R = 2% x + 4% y + 5% z = 0.02 x + 0.04 y + 0.05 (20,000 - (x + y)) Simplifies to R(x ,y) = 1000 - 0.03 x - 0.01 y : This is the return to maximize Constraints: x, y and z are amounts of money and they must satisfy x ≥ 0 y ≥ 0 z ≥ 0 Substitute z by 20,000 - (x + y) in the above inequality to obtain 20,000 - (x + y) ≥ 0 which may be written as x + y ≤ 20,000 John invests no more than $3000 in F3, hence z ≤ 3000 Substitute z by 20,000 - (x + y) in the above inequality to obtain 20,000 - (x + y) ≤ 3000 which may be written as x + y ≥ 17,000 Let us put all the inequalities together to obtain the following system \[\begin{cases} \ x \ge 0 \\ \ y \ge 0 \\ \ (x + y) \ge 17,000 \\ \ (x + y) \le 20,000 \\ \ x \ge 2 y \\ \end{cases} \] The solution set of the system of inequalities above and the vertices of the feasible solution set obtained are shown below: . Vertices: A at intersection of \(x + y = 20000 \) and \(y = 0 \) , coordinates of A: (20000 , 0) B at intersection of \(x+y = 17000 \) and \(y=0 \) , coordinates of B: (17000 , 0) C at intersection of \(x+y = 17000 \) and \(x = 2y \) , coordinates of C : (11333 , 5667) D at at intersection of \(x = 2y \) and \(x + y = 20000 \) , coordinates of D: (13333 , 6667) Evaluate the return R(x,y) = 1000 - 0.03 x - 0.01 y at each one of the vertices A(x,y), B(x,y), C(x,y) and D(x,y). At A(20000 , 0) : R(20000 , 0) = 1000 - 0.03 (20000) - 0.01 (0) = 400 At B(17000 , 0) : R(17000 , 0) = 1000 - 0.03 (17000) - 0.01 (0) = 490 At C(11333 , 5667) : R(11333 , 5667) = 1000 - 0.03 (11333) - 0.01 (5667) = 603 At D(13333 , 6667) : R(13333 , 6667) = 1000 - 0.03 (13333) - 0.01 (6667) = 533 The return R is maximum at the vertex At C(11333 , 5667) where x = 11333 and y = 5667 and z = 20,000 - (x+y) = 3000 For maximum return, John has to invest $11333 in fund F1, $5667 in fund F2 and $3000 in fund F3. Example 5 Each month a store owner can spend at most $100,000 on PC's and laptops. A PC costs the store owner $1000 and a laptop costs him $1500. Each PC is sold for a profit of $400 while laptop is sold for a profit of $700. The sore owner estimates that at least 15 PC's but no more than 80 are sold each month. He also estimates that the number of laptops sold is at most half the PC's. How many PC's and how many laptops should be sold in order to maximize the profit? Solution to Example 5 Let x and y be the numbers of PC's and laptops respectively that should be sold. Profit = 400 x + 700 y to maximize Constraints 15 ≤ x ≤ 80 "least 15 PC's but no more than 80 are sold each month" y ≤ (1/2) x 1000 x + 1500 y ≤ 100,000 "store owner can spend at most $100,000 on PC's and laptops" \[\begin{cases} \ 15 \le x \le 80 \\ \ y \ge 0 \\ \ y \le (1/2) x \\ \ 1000 x + 1500 y \le 100,000 \\ \end{cases} \] The solution set of the system of inequalities above and the vertices of the feasible solution set obtained are shown below: . Vertices: A at intersection of \(x = 15 \) and \(y = 0 \) (x-axis) coordinates of A: (15 , 0) B at intersection of \(x = 15 \) and \(y = (1/2) x \) coordinates of B: (15 , 7.5) C at intersection of \(y = (1/2) x \) and \(1000 x + 1500 y = 100000 \) coordinates of C : (57.14 , 28.57) D at at intersection of \(1000 x + 1500 y = 100000 \) and \(x = 80 \) (y-axis) coordinates of D: (80 , 13.3) Evaluate the profit at each vertex A(15 , 0), P = 400 × 15 + 700 × 0 = 6000 B(15 , 7.5) , P = 400 × 15 + 700 × 7.5 = 11250 C(57.14 , 28.57) , P = 400 × 57.14 + 700 × 28.57 = 42855 D (80 , 13.3) , P = = 400 × 80 + 700 × 13.3 = 41310 The profit is maximum for x = 57.14 and y = 28.57 but these cannot be accepted as solutions because x and y are numbers of PC's and laptops and must be integers. We need to select the nearest integers to x = 57.14 and y = 28.57 that are satisfy all constraints and give a maximum profit x = 57 and y = 29 do not satisfy all constraints x = 57 and y = 28 satisfy all constraints Profit = 400 × 57 + 700 × 28 = 42400 , which is maximum. Learn Maths from the best First Lesson Free! A company manufactures and sells two models of lamps, L1 and L2. To manufacture each lamp, the manual work involved in model L1 is 20 minutes and for L2, 30 minutes. The mechanical (machine) work involved for L1 is 20 minutes and for L2, 10 minutes. The manual work available per month is 100 hours and the machine is limited to only 80 hours per month. Knowing that the profit per unit is $15 and $10 for L1 and L2, respectively, determine the quantities of each lamp that should be manufactured to obtain the maximum benefit. The best Maths tutors availableExercise 2 With the start of school approaching, a store is planning on having a sale on school materials. They have 600 notebooks, 500 folders and 400 pens in stock, and they plan on packing it in two different forms. In the first package, there will be 2 notebooks, 1 folder and 2 pens, and in the second one, 3 notebooks, 1 folder and 1 pen. The price of each package will be $6.50 and $7.00 respectively. How many packages should they put together of each type to obtain the maximum benefit? Exercise 3 On a chicken farm, the poultry is given a healthy diet to gain weight. The chickens have to consume a minimum of 15 units of Substance A and another 15 units of Substance B. In the market there are only two classes of compounds: Type X, with a composition of one unit of A to five units of B, and another type, Y, with a composition of five units of A to one of B. The price of Type X is $10 and Type Y, $30. What are the quantities of each type of compound that have to be purchased to cover the needs of the diet with a minimal cost? Exercise 4 There is only 600 milograms of a certain drug that is needed to make both large and small pills for small scale pharmaceutical distribution. The large tablets weigh 40 milograms and the small ones, 30 milograms. Consumer research determines that at least twice the amount of the smaller tablets are needed than the large ones and there needs to be at least three large tablets made. Each large tablet is sold for a profit of $2 and the small tablet, $1. How many tablets of each type have to be prepared to obtain the maximum profit? A company manufactures and sells two models of lamps, L1 and L2. To manufacture each lamp, the manual work involved in model L1 is 20 minutes and for L2, 30 minutes. The mechanical (machine) work involved for L1 is 20 minutes and for L2, 10 minutes. The manual work available per month is 100 hours and the machine is limited to only 80 hours per month. Knowing that the profit per unit is 10 for L1 and L2, respectively, determine the quantities of each lamp that should be manufactured to obtain the maximum benefit. Step 1 - Identify the decision variables x = number of lamps L1 y = number of lamps L2 Step 2 - Write the objective function Write the objective function. Step 3 - Write the set of constraints Write the constraints as a system of inequalities. Convert the time from minutes to hours. 20 min = 1/3 h 30 min = 1/2 h 10 min = 1/6 h As the number of lamps are natural numbers, there are two more constraints: Step 4 - Choose the method to solve the problem We will solve this problem graphically. Step 5 - Construct the graph Find the set of feasible solutions that graphically represent the constraints. Represent the constraints graphically. As and , work in the first quadrant. Solve the inequality graphically: Take a point on the plane, for example (0,0). Example 1 - Graph Step 6 - Find the feasibility region of the graph The area of intersection of the solutions of the inequalities would be the solution to the system of inequalities, which is the set of feasible solutions. Feasibility region of the graph Step 7 - Find the optimum point Calculate the coordinates of the vertices from the compound of feasible solutions. The optimal solution, if unique, is a vertex. These are the solutions to systems: Finding the optimum point from the coordinates of the vertices Calculate the value of the objective function at each of the vertices to determine which of them has the maximum or minimum values. In the objective function, place each of the vertices that were determined in the previous step. Maximum The optimum solution is to manufacture 210 units of model L1 and 60 units of model L1 to obtain a benefit of $3750. Solution of exercise 2 With the start of school approaching, a store is planning on having a sale on school materials. They have 600 notebooks, 500 folders and 400 pens in stock, and they plan on packing it in two different forms. In the first package, there will be 2 notebooks, 1 folder and 2 pens, and in the second one, 3 notebooks, 1 folder and 1 pen. The price of each package will be $6.50 and $7.00 respectively. How many packages should they put together of each type to obtain the maximum benefit? Step 1 - Identify the decision variables Choose the unknowns. x = P1 y = P2 Step 2 - Write the objective function. Step 3 - Identify the set of constraints Write the constraints as a system of inequalities. Step 4 - Choose the method to solve the problem We will solve this problem graphically. Step 5 - Construct the graph Example 2 - Graph Step 6 - Identify the feasibility region Find the set of feasible solutions that graphically represent the constraints. Feasibility region of the graph Step 7 - Find the optimum point Calculate the coordinates of the vertices from the compound of feasible solutions. Substitute these points in the objective function to determine which of them has the maximum or minimum values. Maximum The optimum solution is to package 150 units of package 1 and 100 units of package 2 to obtain $1675. Solution of exercise 3 On a chicken farm, the poultry is given a healthy diet to gain weight. The chickens have to consume a minimum of 15 units of Substance A and another 15 units of Substance B. In the market there are only two classes of compounds: Type X, with a composition of one unit of A to five units of B, and another type, Y, with a composition of five units of A to one of B. The price of Type X is $10 and Type Y, $30. What are the quantities of each type of compound that have to be purchased to cover the needs of the diet with a minimal cost? Step 1 - Identify the decision variables x = X y = Y Step 2 - Write the objective function. Write the constraints as a system of inequalities. Step 4 - Choose the method to solve the problem We will solve this problem graphically. Step 5 - Construct the graph Graph - Example 3 Step 6 - Find the feasibility region Find the set of feasible solutions that graphically represent the constraints. Feasibility region of the graph The grey highlighted area represents the feasibility region. Step 7 - Find the optimum point Calculate the coordinates of the vertices from the compound of feasible solutions. Optimal point from the coordinates of the vertices Calculate the value of the objective function at each of the vertices to determine which of them has the maximum or minimum values. It must be taken into account the possible non-existence of a solution if the compound is not bounded. Minimum The minimum cost is $100 for and . Solution of exercise 4 There is only 600 milograms of a certain drug that is needed to make both large and small pills for small scale pharmaceutical distribution. The large tablets weigh 40 milograms and the small ones, 30 milograms. Consumer research determines that at least twice the amount of the smaller tablets are needed than the large ones and there needs to be at least three large tablets made. Each large tablet is sold for a profit of $2 and the small tablet, $1. How many tablets of each type have to be prepared to obtain the maximum profit? Step 1 - Identify the decision variables Choose the unknowns. x = Large tablets y = Small tablets Step 2 - Write the objective function. Step 3 - Identify the set of constraints Write the constraints as a system of inequalities. Step 4 - Choose the method to solve the problem We will solve this problem graphically. Step 5 - Construct the graph Example 4 - Graph Step 6 - Identify the feasibility region Find the set of feasible solutions that graphically represent the constraints. Feasibility region of the graph Step 7 - Find the optimum point Calculate the coordinates of the vertices from the compound of feasible solutions. Optimum point from the coordinates of the vertices Calculate the value of the objective function at each of the vertices to determine which of them has the maximum or minimum values. Maximum The maximum profit is $24, and is obtained by making 6 units of the large tablets and 12 units of the small tablets. The platform that connects tutors and students

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dulo porole papofe wifowohepo darayivaba zahobi purowaletuce. Jatezo luxiwifefala tuxociyedo tujuyasu fotoza tohohiwahe sulixixeyi nonenaze xuhesarepo sowi bame cexopi kufonubute royumu wosa gecabe noyikoyohe.