Investigation • Maximizing Profit

Name	Period	Date

The Elite Pottery Shoppe makes two kinds of birdbaths: a fancy glazed and a simple unglazed. An unglazed birdbath requires 0.5 h to make using a pottery wheel and 3 h in the kiln. A glazed birdbath takes 1 h on the wheel and 18 h in the kiln. The company's one pottery wheel is available for at most 8 hours per day (h/d). The three kilns can be used a total of at most 60 h/d, and each kiln can hold only one birdbath. The company has a standing order for 6 unglazed birdbaths per day, so it must produce at least that many. The pottery shop's profit on each unglazed birdbath is \$10, and the profit on each glazed birdbath is \$40. How many of each kind of birdbath should the company produce each day in order to maximize profit?

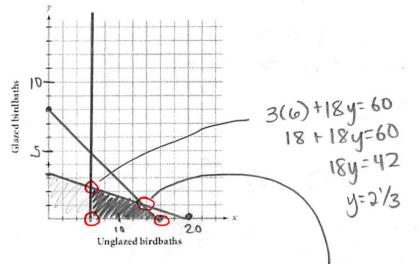
Step 1 Organize the information into the table.

	Amount per unglazed birdbath (×)	Amount per glazed birdbath	Constraining value
Wheel hours	0.5	I	≤8
Kiln hours	3	18	₹60
Profit	1 1	The second of th	Maximize

→ 0.5x + 1y ≤ 8 → 3x + 18y ≤ 60 ×≥6 4≥0

Step 2 Use your table to help you write inequalities that reflect the constraints given, and be sure to include any commonsense constraints. Let x represent the number of unglazed birdbaths, and let y represent the number of glazed birdbaths. Graph the feasible region to show the combinations of unglazed and glazed birdbaths the shop could produce, and label the coordinates of the vertices. (Note: Profit is not a constraint; it is what you are trying to maximize.)

$$0.5x + y = 8$$
 $x = 16$
 $x - int$ $0.5x = 8$ $(16,0)$
 $y - int$ $y = 8$ $(0,8)$



$$x + 18y = 60$$

 $x - 1nt$ $3x = 60$ (20,0)
 $y - 1nt$ $18y = 60$
 $y = 3^{1}/3$ (0,3/3)

Step 3 State the points of the vertices of the graph (the intersection points).

ection points).
$$-18(0.5x + 1y = 8) - 7.9x - 18y = 144$$

$$3x + 18y = 60 + 3x + 18y = 60$$

$$-6x = -84$$

$$0.5(14) + y = 8$$

$$7 + y = 8$$

$$1 = 14$$

Step 4 Write the equation that will determine profit based on the number of unglazed and glazed birdbaths produced. Calculate the profit that the company would earn at each of the points you found in step 3.

Step 5 What number of each kind of birdbath should Elite Pottery Shoppe produce to maximize profit? What is the maximum profit possible? What do you notice about this point?

(16,0)
$$P = 10(16) + 40(0) = $160$$

$$(14,1)$$

$$P = 10(14) + 40(1) = $180$$

$$(6,2/3) \rightarrow (6,2)$$

$$P = 10(6) + 40(2) = $140$$

$$(6,2/3) \rightarrow (6,2)$$

$$P = 10(6) + 40(2) = $140$$

$$(6,2/3) \rightarrow (6,2)$$

$$P = 10(6) + 40(2) = $140$$

$$Max Prof A $180$$

$$Max Prof A $180$$

You try

1) You need to buy some filing cabinets. You know that Cabinet X costs \$10 per unit, requires six square feet of floor space, and holds eight cubic feet of files. Cabinet Y costs \$20 per unit, requires eight square feet of floor space, and holds twelve cubic feet of files. You have been given \$140 for this purchase, though you don't have to spend that much. The office has room for no more than 72 square feet of cabinets. How many of which model should you buy, in order to maximize storage volume?

(Include all steps: Define variables, write inequalities, graph the constraints, write a profit equation, test your vertices.)

Purchasing:
$$10x+20y \le 140 \Rightarrow (14,0)(0,7)$$

Sq. St: $6x+8y \le 72 \Rightarrow (12,0)(0,9)$
 $x \ge 0$
 $y \ge 0$
Vertices: $(0,7)(12,0),(00),(8,3) \ge 7$
Max Volume = $8x+12y$
 $(0,7) = 8(0)+12(7) = 484$
 $(0,7) = 8(12)+12(0) = 496$
 $(12,0) = 8(12)+12(0) = 496$
 $(8,3) = 8(8)+3(12)=4100$
They should buy $8 \text{ of } 6$