HMW 1: Linear Prog.

1. Consider the following linear programming problem, and find the solution graphically.

Maximize	$4X + 15Y$
Subject to:	$3X + 4Y \leq 480$
	$4X + 2Y \leq 360$
	$3X-5Y \geq 150$
	$X+Y \geq 60$
	$Y \geq 40$
	all variables ≥ 0

2. As a supervisor of a production department, you must decide the daily production totals of a certain product that has two models, the Deluxe and the Special. The profit on the Deluxe model is $12 per unit and the Special's profit is $10. Each model goes through two phases in the production process, and there are only 100 hours available daily at the construction stage and only 80 hours available at the finishing and inspection stage. Each Deluxe model requires 20 minutes of construction time and 10 minutes of finishing and inspection time. Each Special model requires 15 minutes of construction time and 15 minutes of finishing and inspection time. The company has also decided that the Special model must comprise at least 40 percent of the production total.

   (a) Formulate this as a linear programming problem.
   (b) Find the solution that gives the maximum profit.
   (c) Discuss the sensitivity reports

3. Sunco Oil manufactures three types of gasoline (gas 1, gas 2, and gas 3). Each type is produced by blending three types of crude oil (crude 1, crude 2, and crude 3). The sales price per barrel of gasoline and the purchase price per barrel of crude oil are given in the Table1. Sunco can purchase up to 5,000 barrels of each type of crude oil daily. The three types of gasoline differ in their octane rating and sulfur content. The crude oil blended to form gas 1 must have an average octane rating of at least 10 and contain at most 1% sulfur. The crude oil blended to form gas 2 must have an average octane rating of at least 8 and contain at most 2% sulfur. The crude oil blended to form gas 3 must have an octane rating of at least 6 and contain at most 1% sulfur. The octane rating and the sulfur content of the three types of oil are given in Table 2. It costs $4 to transform one barrel of oil into one barrel of gasoline, and Sunco's refinery can produce up to 14,000 barrels of gasoline daily. Sunco's customers require the following amounts of each gasoline: gas 1—3,000 barrels per day; gas 2—2,000 barrels per day; gas 3—1,000 barrels per day. The company considers it an obligation to meet these demands. Sunco also has the option of advertising to stimulate demand for its products. Each dollar spent daily in advertising a particular type of gas increases the daily demand for that type of gas by 10 barrels. For example, if Sunco decides to spend $20 daily in advertising gas 2, then the daily demand for gas 2 will increase by 20(10) _ 200 barrels. Formulate an LP that will enable Sunco to maximize daily profits (profits _ revenues _ costs).

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Table 1: Gas and Crude Oil Prices for Blending

Gas	Sales Price per Barrel ($)	Crude	Purchase Price per Barrel ($)
1	70	1	45
2	60	2	35
3	50	3	25

Table 2: Octane Ratings and Sulfur Requirements for Blending

Crude	Octane Rating	Sulfur Content (%)
1	12	0.5
2	6	2.0
3	8	3.0