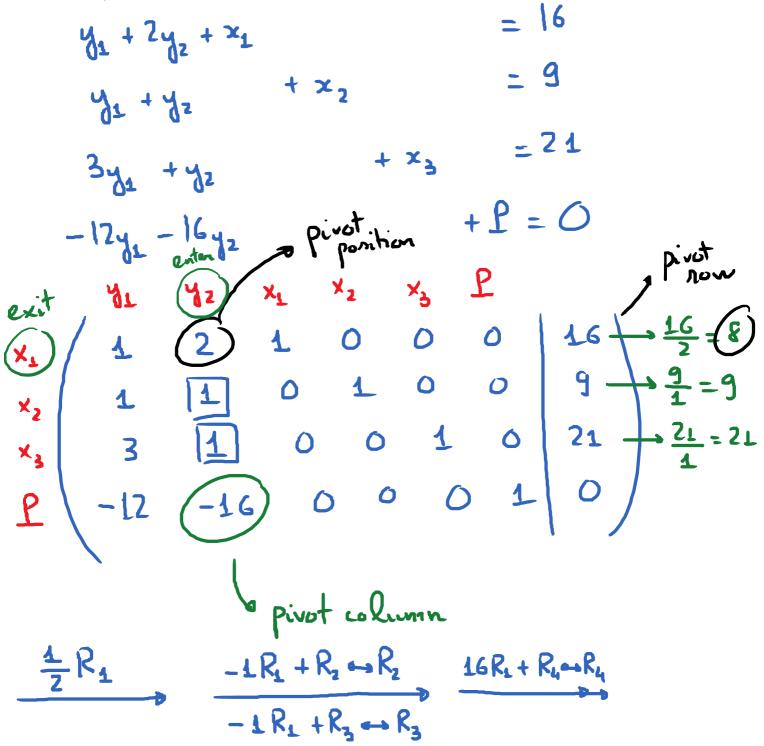
6.3. The Dual Problem Wednesday, March 7, 2018 12:34 PM Goal: Solve minimization problem with constraints of the form >. Recap: The simplex method helps is solve maximization problem with constraints of the form  $\leq$ . For e.g., Maximize P = 5x + 10ySubject to: 8x + 8y \le 160  $4x + 12y \le 180$ . To day, the problem is: Minimize  $C = 16x_1 + 9x_2 + 21x_3$ . Subject to:  $x_1 + x_2 + 3x_3 \ge 12$ .  $2x_1 + x_2 + x_3 \ge 16$ .  $x_1, x_2, x_3 \ge 0$ Key idea for solving these minimization problems: to translate this back into maximization problems with  $\leq$  constraints and apply the Simplex Method.

Wednesday, March 7, 2018 Here are the steps: Step 1 : Write down the Initial Matrix for the problem (Crefficients for the objective function must be in the bottom now) Initial Matrix  $A = \begin{pmatrix} 1 & 1 & 3 \\ 2 & 1 & 1 \\ 16 & 9 & 21 \end{pmatrix}$ 12 16 1 a 3-by-4 matrix. Step 2: Find the transpose of the initial matrix. The transpose of a matrix A is another matrix, denoted by A'. Columnsof A -> nows of AT and Rows of A -> columns of A<sup>T</sup>

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Maximize 
$$P = 12y_1 + 16y_2$$
  
Subject to the constraints:  
 $y_1 + 2y_2 \leq 16$   
 $y_2 + y_2 \leq 9$   
 $3y_1 + y_2 \leq 21$   
Step 4: Apply the Simplex method from last time to  
rolve this dual problem.  
\* Introduce slach variables  
\* Form the Simplex Tablean.  
\* Identify pivet positions.  
\* Apply row operations to reduce simplex tablean.  
\* Keep truch of exiting and entering variable.



Wednesday, March 7, 2018 1:22 PM xT **4**2 8/1/2 6 0 0 0  $L = \frac{L}{2}$ 42 10  $-\frac{L}{2}$ 0 13 1 0  $-\frac{4}{2}$ 0 5 0  $\begin{array}{c}
0 \\
-\frac{5}{2}R_2 + R_3
\end{array}$ 0 -> pivot position -> turn it to 1 -> row openations P X3 X<sub>2</sub> 91 81 XL 1 <u>1</u> -<u>1</u> 0 -<u>1</u> 2 0 -1 0 Y2 U 0 31 8 0 1 - 5 02 1 P 8 6 4 0 0 Solution to the dual problem is  $y_1 = 2$ ;  $y_2 = 7$ ; max P = 136

Step 5: The Solution to the original minimization problem can be read off from the bottom row of the tableau. So,  $x_1 = 4$ ;  $x_2 = 8$ ;  $x_3 = 0$ Min C = 136