|  |  |  |  |
| --- | --- | --- | --- |
| Let  **X1** = Number of packets of Food A | | |  |
| **X2**=Number of packets of Food B | |  |  |
|  |  |  |  |
| **Min cost =** | **5X1 + 3 X2** |  |  |
| **Subject to:** |  |  |  | |
|  | **5X1 + 7X2 >= 50** |  | Nutrient 1 | |
|  | **10X1 + 3X2 >= 40** |  | Nutrient 2 | |

The dotted line represents a cost of $15, which is not feasible, since to satisfy the constraints, one has to be on the side of the lines away from the origin, since the constraints are of the >= type.

So the lowest possible cost is when you move the dotted line parallel to itself away from the origin, until you hit the first point in the feasible region. This point is the intersection of the two constraints.

**SENSITIVITY VIA THE GRAPH**

**Q: What must be the new cost of Food B to make X1 = 10 the optimal solution?**

**Answer:** If the cost line (dotted) were parallel to constraint N1 (Blue), then the segment along the blue line would be optimal. If the slope went a little lower than that, then the point X1 = 10 would become the optimal.

How do we compute this? Note that for constraint 1, the ratio of the coefficients for X1 and X2 is 5:7.

The ratio in the cost equation is currently 5:3, where 3 represents the cost of Food B. So if the cost of Food B were to change to $7, the new equation for cost would be 5X1 + 7X2, which would have the same slope as the constraint for N1. Thus, if the cost of Food B were greater than $7 per packet, the solution would change to X1 = 10, which is the point on the far right of the constraint, rather than the intersection of the two constraints.

In other words, the cost per packet for Food B could change from $3 to $7 (an increase of upto $4) without affecting the current solution.

Can you similarly figure out what must happen to the price of Food A to make the same thing happen, if we were to keep the cost of Food B constant at $3?