- 1. The Smith Manufacturing Company produces chairs. An analysis of their accounting data reveals:
-     Fixed cost $50,000 per year
-     Variable cost $2 per chair
-     Capacity   20,000 chairs per year
-     Selling price $7 per chair
- a. Compute the break-even point in number of chairs.
- b. If sales (forecasted or actual) = 12,000, what is the margin of safety?
- c. Find the number of chairs Smith must sell to show a profit of $30,000.
- d. What is the fixed cost per chair at 75 percent of capacity?

BEP=TFC/(P-VC)

- $50,000/($7-$2)
- =10,000 UNITS

- **Margin of Safety= Sales – Break Even**
- =12,000 -10,000
- =2,000 units

Problems from Handout

Desired Profit (DP)

- Qty to Sell for Desired Profit
- $QTY = (TFC + DP)/(P - VC)$
- $(50{,}000 + 30{,}000)/(7 - 2)$
- $= 16{,}000$ units to realize profit of \$30,000

Fixed Cost per Unit

- 20,000 units =100% capacity
- 75% capacity =15,000 (20,000X.75)
- Fixed Cost Per Unit at 75% capacity
- =$50,000/15,000
- =$3.33 per chair

- 2. The Taylor Feed Company produces feeds for chickens, hogs, cattle, and dogs. From available records we know the following:

	Selling price per ton	VC per ton	Percent of $ sales volume
Feed for			
Chickens	$30	$15	40%
Hogs	40	15	20
Cattle	36	16	25
Dogs	32	12	15

- Annual fixed costs: $80,000
- a. Find the total contribution per overall sales dollar with the present product mix.
- b. Find the break-even in dollars.
- c. Find the margin of safety in $'s
  - If $ Sales = $175,000

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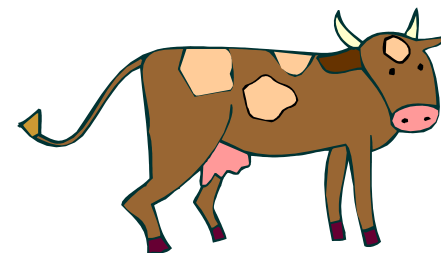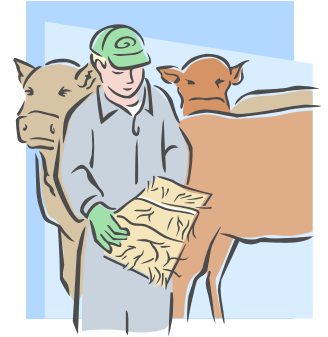
- Chickens $(30-15)/30=.50$
- Hogs $(40-15)/40=.625$
- Cattle $(36-16)/36=.55$
- Dog $(32-12)/32=.625$

Multiple Products

- Chickens .50*.40   = .20
- Hogs   .625*.2   = .125
- Cattle   .55*.25   = .137
- Dog   .625*.15   =.094

- Avg. Contribution   = .556

BEP ($)

= TFC/CONTRIBUTION (as a decimal)

- =80,000/.55
- =$145,454
- Margin of Safety
- =$175,000 – 145,454
- =$29,456

- 3.   The Holmes Shoe Store currently stocks three lines of ladies' shoes. Holmes is considering dropping one line of shoes and adding two more. From the data given, decide whether or not Holmes should make this change. Give your reasons.
- SHOES NOW STOCKED

Type	Selling Price	VC per pair	Sales this year
Flats	$10	$6	$30,000
Golf	16	12	10,000
Dress	20	12	60,000
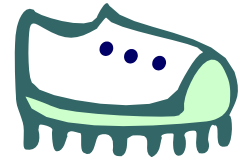
- Fixed costs: $30,000
- SHOES STOCKED IF PROPOSAL IS ACCEPTED

Type	Selling Price	VC per pair	Expected sales
Flats	$10	$6	$25,000
Dress	20	12	60,000
Evening	16	8	10,000
Bedroom	6	3	5,000
Total			$100,000

Multiple Products

- Flats $(10-6)/10 = .40$

- Golf $(16-12)/16 = .25$

- Dress $(20-12)/20 = .40$

Average Contribution

- Flats   .40*.30   =   .12
- Golf   .25*.10   =   .025
- Dress   .40*.60   =   .24
-
          ____
- Avg. Contribution   .385

$ Contribution

- (.385)*(100,000)= 38,500 $ total (TCN)
contribution

- TCN-TFC=NP

- 38,500-30,000= 8,500

- Flats   (10-6)/10=   .40 *.25   =.10
- Dress (20-12)/20=.40 *.60   =.24
- Evening (16-8)/16 =.50 *.10   =.05
- Bedroom(6-3)/6   =.50 * .05   =.025
- ----------
- Avg. Contribution   .415

Average Contribution

- .415*100,000 = 41,500 (total contribution)
- minus fixed cost 30,000
-                              -----------
- Profit   11,500
- 11,500-8,500 = additional profit of $3,000

- 4. The Monopoly Supply Company is the sole supplier of a patented line of widgets. Because their line of widgets is sold to customers who require them as replacement devices in expensive machinery, Monopoly Supply experiences an inelastic demand pattern in sales (each year they sell exactly 100,000 widgets regardless of price). Recently, however, Monopoly Supply has been threatened by anti-trust actions and has learned, by the grapevine, that they will be slapped with a lawsuit if their profit on widgets next year exceeds 10 percent of their fixed investment in widget production; this investment is $5 million and is depreciated at $500,000 per year. If variable costs are $10 to make a widget, what price should they ask next year in order to realize as much profit as possible but still avoid antitrust litigation?

Monopoly

- TFC=500,000

- VC= 10 per widget

- QTY= 100,000

- INVESTMENT= 5,000,000

- MAXIMUM PROFIT= 5,000,000*.10

$$= \$500,000$$

Revenue Cost Profit

- Total Cost= TFC+TVC

- $\qquad$ = 500,000+(10*100,000)

- $\qquad$ = $1,500,000

- Total Revenue = Total Cost+Max.Profit

- $\qquad$ = 1,500,000 + 500,000

- $\qquad$ = $2,000,000

- Total Revenue = Price*Qty
- Price=Total Revenue/Quantity
- =2,000,000/100,000
- = $20

- 5. A producer of electrical equipment is considering the installation of one of two types of machines. A long-run sales forecast indicates that sales will not fall below 6,200 units per year for the next 5 years, the expected life of each machine. Machine 1 will increase fixed costs by $20,000 per year but will reduce variable costs by $6 per unit. Machine 2 will increase fixed costs by $4,000 per year but will reduce variable costs by $4 per unit. Variable costs now amount to $20 per unit. At what point are you indifferent as to which machine to purchase? Which machine should be bought?
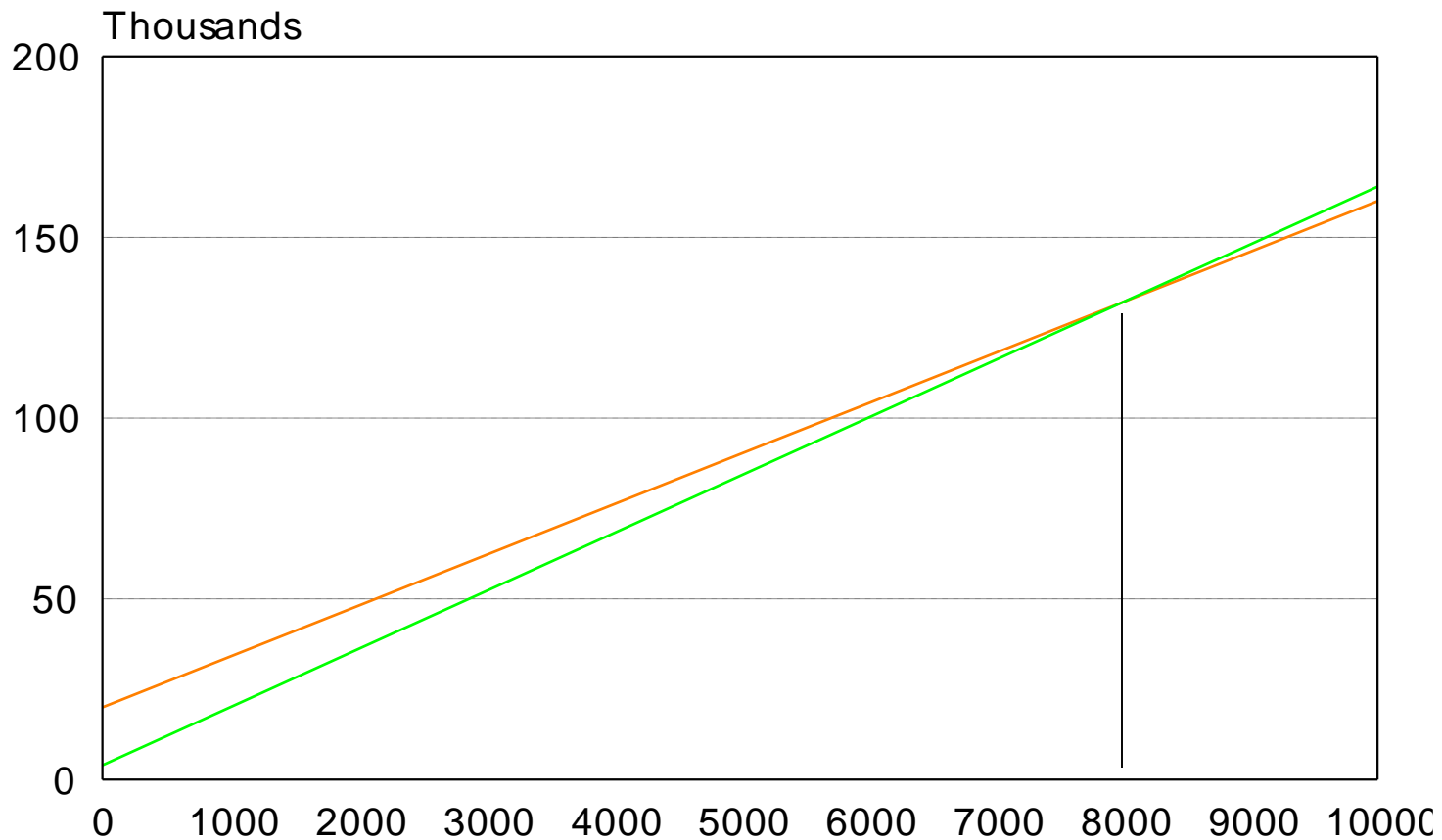
- Machine 1 New V.C. 20-6 =$14
- Machine 2 New V.C. 20-4 = $16

-      Machine 1 = Machine 2
- 20,000+14X = 4,000+16X
- 20,000-4,000 = 16X-14X
-      8,000 = X
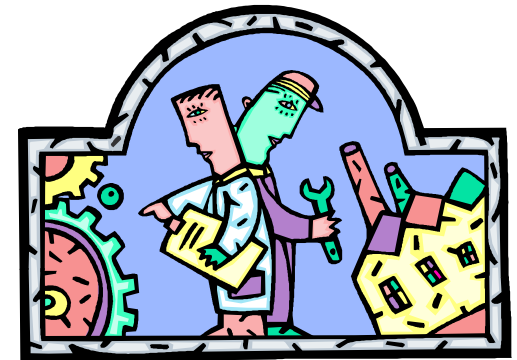
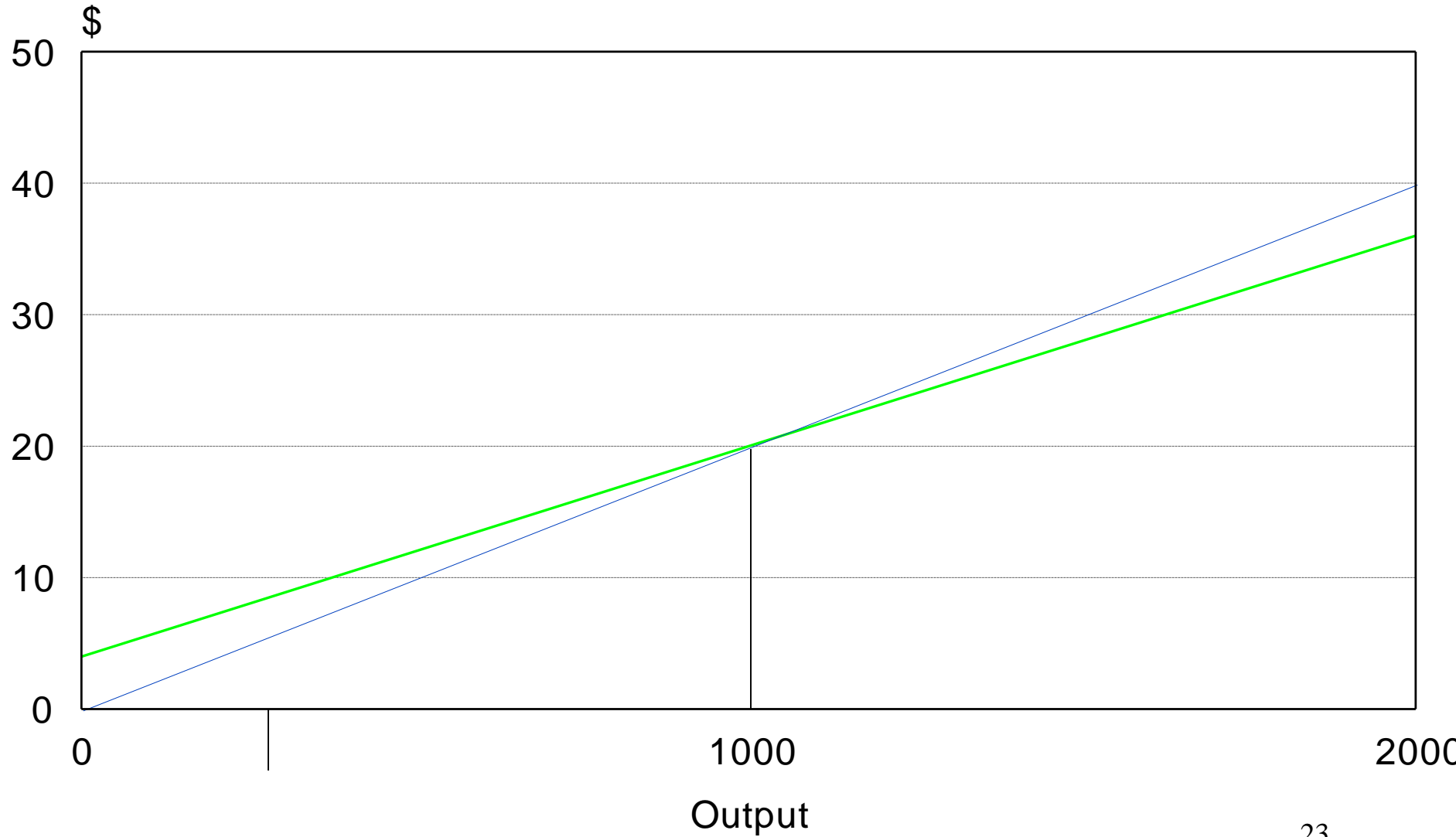Gold=Machine 1
Green=Machine 2
Indifference Point=8000
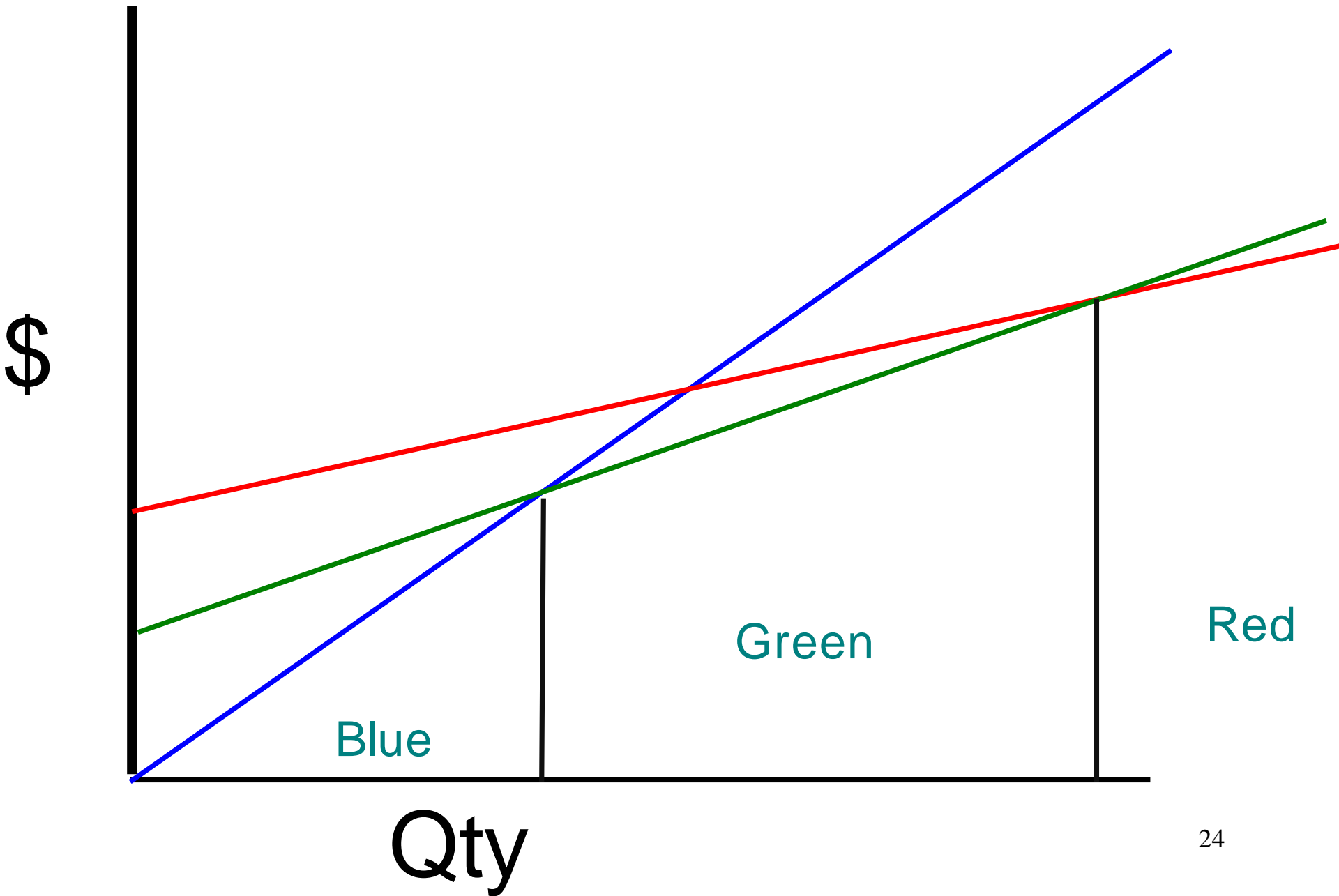
- Do Nothing = Machine 2
- 0+20X = 4,000+16X
- X=1,000

Green=Machine2
Blue=Current Machine
Indifference Point=1000

$

50
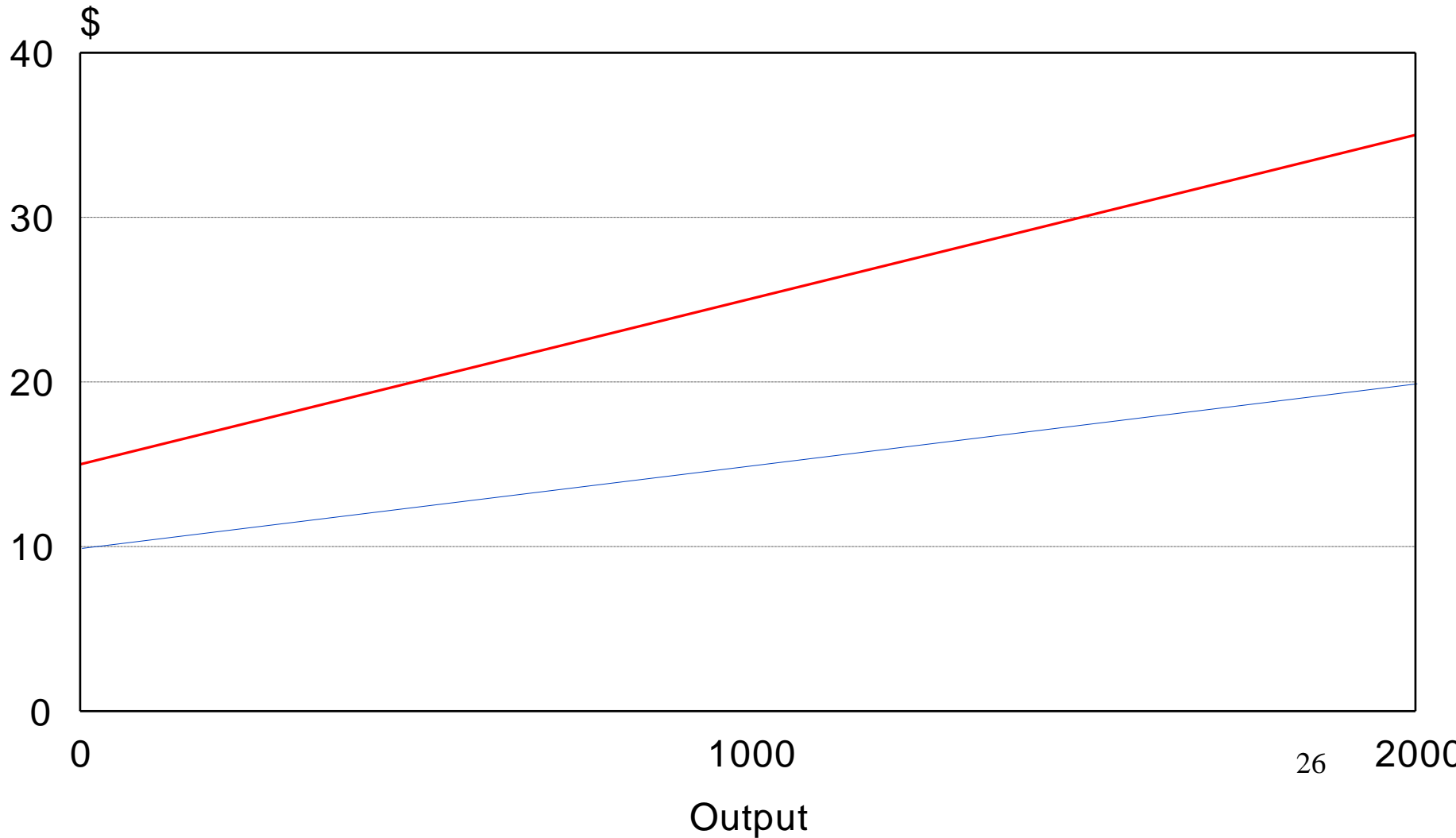
40

30

20

10

0

0   1000   2000

Output

$

Qty

Blue

Green

Red

What if this happened?

- $10,000 + 5X = 15,000 + 10X$
- X = negative number
- (-1,000)

Red = Higher FC & Higher VC
Blue = Lower FC & Lower VC


$

40

30

20

10

0

0   1000   2000

Output

- 6. The Brown Motor Company currently buys exhaust valves for its motors at $2.50 each. An estimate of the cost to the company to manufacture these valves reveals that the fixed costs, will be $4,800 per year and the variable costs per valve will be $1.25 Each motor requires one exhaust valve, and Brown's annual capacity is 6,000 per year. At what percent of capacity does it pay the company to manufacture its own valves?
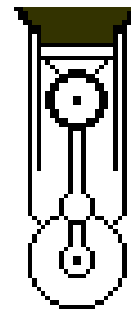
- cost for purchasing = cost for making
- 2.50X   =   4,800+1.25X
- X   =   3,840
- 3,840/6,000
- =64%
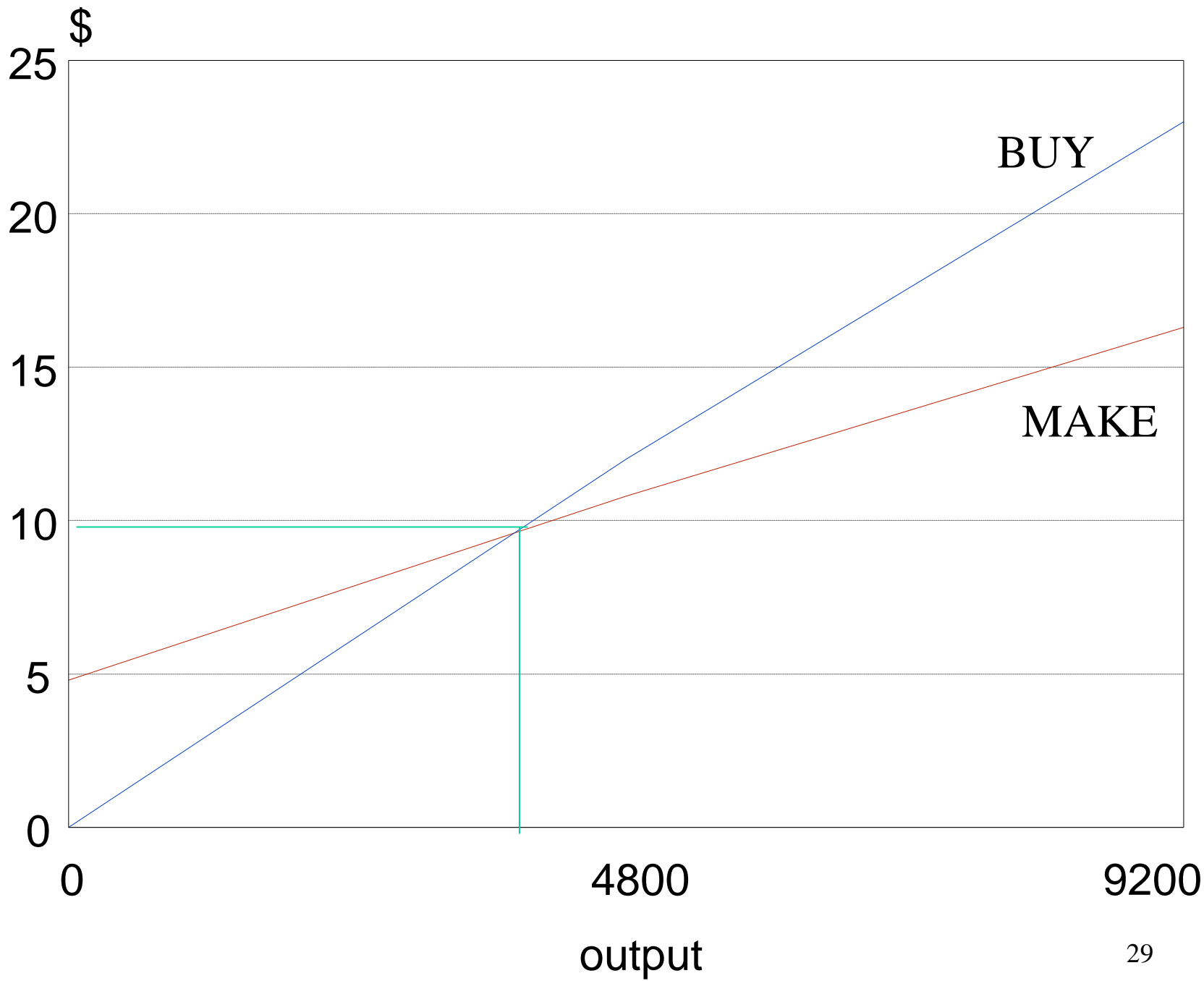
- 7. The King Company is considering an advertising program which will add $7,000 to fixed cost. Their product, now selling for $10, has a variable cost of $3. Current fixed costs are $35,000. How many additional units must be sold to justify the advertising? What is the new breakeven point in units?

TFC\(P-VC) (BEP in units)

7,000/(10-3)=1,000

Current BEP

=35,000/(10-3) **Break-Even Analysis**

=5,000

New BEP=

5,000+1,000

6,000

- 8. Here are a firm's annual costs:

-      Depreciation $40,000
-      Salaries   53,000
-      Materials used   30,000
-      Advertising   15,000
-      Direct labor   8,000
-      Commissions on sales   16,000
-      Taxes (property)   18,000

- This firm sells six products; their total contribution per overall sales dollar is 36 percent. What is the total variable cost at the break-even point?

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- FIXED COSTS   Depreciation   40,000
-     Salaries   53,000
-     Advertising   15,000
-   Taxes   18,000
-     ―――――
-     Total Fixed $126,000

- BEP $=TFC\Contribution (expressed as a decimal)
- 126,000/.36 = $350,000
- At BEP   Total Revenue=Total Cost
- At BEP   TR=TFC+TVC
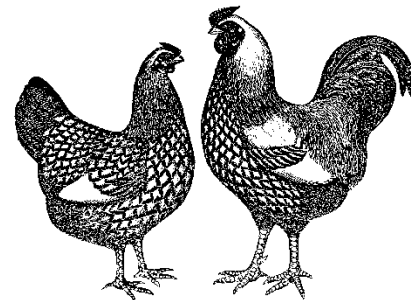- TR-TFC=TVC
- 350,000-126,000= $224,000 TVC at BEP

- The XYZ Railroad operates a train daily over an established route. The railroad accountants have gathered the following cost figures for different train lengths:

	Total cost	Aver. cost per car
Engine and 10 cars	$2,700	$270
Engine and 20 cars	3,200	160
Engine and 30 cars	3,700	123
Engine and 40 cars	4,200	105
Engine and 50 cars (maximum)	4,700	94

- The operation is currently profitable at an average train length of 35 cars. The railroad competes with the Cannonball Truck Line over the same route. The truck line approaches the railroad and offers to pay it $86 per truck to haul trucks piggy-back over the same route. Each railroad flatcar will carry one truck, and the railroad has a plentiful supply of flatcars. Extra costs would be $7.50 per truck to cover the cost of loading and unloading. The trucking company will not guarantee any minimum number of trucks to be hauled. Evaluate this offer in terms of the profit opportunities. The train makes

- 300 round trips annually.

- Price>Variable Cost?
- $86>94?   What is included in the $94
- What is the current variable cost?
- $50 (500/10)
- New Variable Cost=
- $50+$7.5= $57.50
- Price>Variable Cost?
- $86>$57.5 (Difference is $28.50 contribution)
- Where does this show up on our financial statements?
- The only relevant cost in the short run = VC
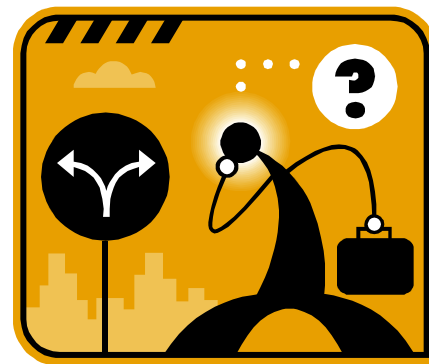
- 10. The government of Utopia is interested in placing price controls on chickens in order to curb inflation. Their interests are two-fold: 1) to hold down consumer prices and (2) to avoid any reduction in the production of chickens. One problem they face is that the cost of chicken feed has been rising. It currently costs $1 to raise one chicken to maturity. The Utopian officials are aware that total fixed costs for chicken production are stable at $2 million per year and that each year 4 million chickens are marketed in the country. If a price ceiling of $2 is set for each chicken sold by the farmer, how high could feed costs rise before the government should expect the farmers to curtail production? Assume farmers will produce as long as they do not incur a loss.

- at BEP Total Revenue=Total Cost (TFC+TVC)
- TR = 4,000,000chickens * $2
- 8,000,000=2,000,000+4,000,000X
- solve for X
- 6,000,000=4,000,000X
- so X=$1.50

- 11.   The ABC Motel consists of 50 rooms as follows: 20 single rooms which rent for $8 per night, 15 double rooms which rent for $12 per night, and 15 triple rooms which rent for $16 per night. Fixed cost annually amounts to $85,000 which includes all labor. Supplementary variable charges are $3 per room per night, covering linen, power, soap, etc. The rooms are rented in roughly the same ratio as their numbers - as many double rooms are rented as triple rooms, and one-third more single rooms are rented than double rooms. Compute the break- point in percentage occupancy, assuming a year of 360 nights. What level of occupancy would promote a profit of $38,000 annually?

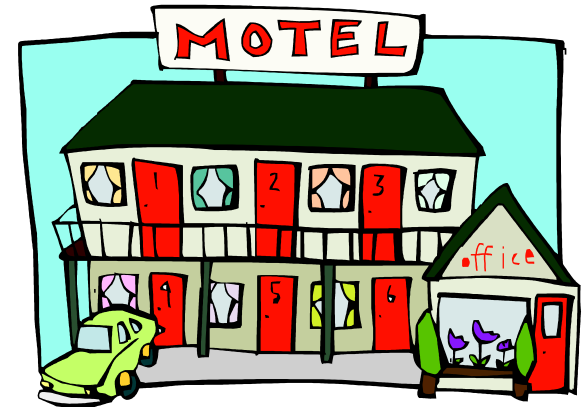- Total revenue if all rooms are rented

- 20*8=   160

- 15*12= 180

- 15*16= 240

-

  _____

- $580

- average price per room is

- 580/50   or $11.60 per room

- Fixed cost per day is 85,000/360
- = $236 per day
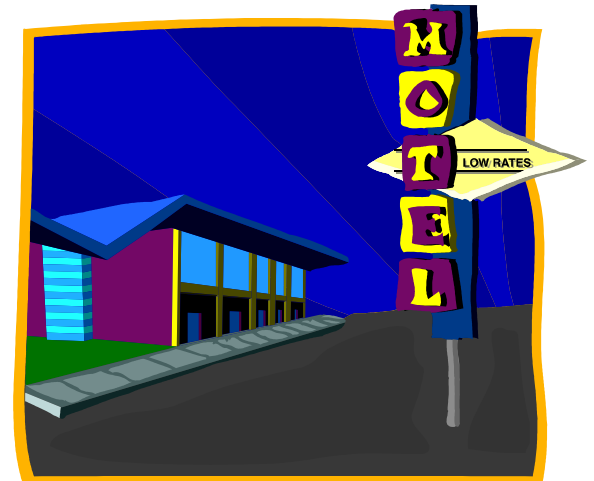
- average price per room   11.60
- minus relevant variable cost   3.00
- = average contribution is   8.60

- FC/(P-VC)
- = 236/(11.6-3.00) =   27.4 rooms
- 27.4/50
- or 55% occupancy rate to break even

- 38,000/360=105.55
- Profit Per Day to Make $38,000 Per Year
- Desired profit in units =
- (fixed cost + desired profit)/(contribution)
- (236+105.55)/(11.6-3.00)
- = 39.7 rooms or 40
- 40/50 = 80%

OPERATIONS MANAGEMENT HOMEWORK PROBLEMS

- 1. The Beta Manufacturing Company produces stepladders that sell for $27 each. The production capacity is limited to 48,000 units per year. Fixed costs are $50,000 and variable costs are $12 per item. Compute the break-even point in number of stepladders. How many items must be sold to provide a profit of $20,000 What is allocation of fixed costs per stepladder at 75 percent capacity?

OPERATIONS MANAGEMENT HOMEWORK PROBLEMS

- 2. A firm produces four models of tool sets. The fixed costs are $42,000 and the other data are as follows:

Model	Qty	Price	Variable Cost	Sales Revenue
S	4,000	$20	6	$80,000
T	5,000	32	8	$160,000
U	1,000	60	20	$60,000
V	2,000	50	18	$100,000
Total				$400,000

- Determine the break-even in dollars.
- What is the Margin of Safety if Sales =$75,000?

OPERATIONS HOMEWORK PROBLEMS

- 3.   The Clutch Engineering Company is proposing to locate a branch office in one of two West Coast locations, A or B. These two sites have quite different estimated operating costs:

	A	B
Engineering labor cost	$15/hr.	$16/hr.
Materials and supplies	2.40/hr.	$1.80/hr.
(tied to engineering hours)		
Variable overhead	5.50/hr.	4.40/hr.
Total annual fixed cost	$150,000	$190,000
Price to customers.	$30	$30

- Consider the hourly costs to be variable costs.

- a. Compute the break-even for both locations.

- b. At what level of output (number of hours) are you in-different to the location?