MPM2D May 27

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Max/Min Money Applications

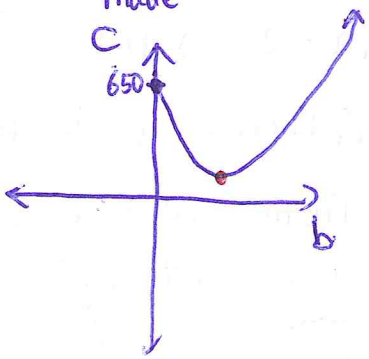
* Unit test will occur on Monday, June 1st

Example 1 A glassworks company that makes crystal bowls has a daily production cost C in dollars given by the relation $C = 0.2b^2 - 10b + 650$, where b is the number of bowls made. How many bowls should be made to minimize the production cost? What is the cost when this many bowls are made?

minimum C = ? → Find vertex

C = cost

b = # of bowls made



$C = 0.2(b^2 - 50b) + 650$ * $a = 0.2 > 0 \rightarrow \cup$

$C = 0.2\left[b^2 - 50b + \left(\frac{-50}{2}\right)^2 - \left(\frac{-50}{2}\right)^2\right] + 650$ ($a = b$, $b = -25$)

$C = 0.2[(b-25)^2 - 625] + 650$

$C = 0.2(b-25)^2 + 650 + (-625 \times 0.2)$

$C = 0.2(b-25)^2 + 650 - 125$

$C = 0.2(b-25)^2 + 525 \rightarrow$ Vertex = (25, 525)

∴ The minimum cost is 525 dollars when they make 25 bowls.

Example 2 Two students decided to make lucky Pikachu T-shirts and sell them. The first day, they sold the T-shirts at \$15. They sold 40 T-shirts. They ran around surveying the students around their school to find out how much they should charge to make the most revenue. = max point Students said that for each 10 cent decrease, 2 more people would buy a shirt. What price should they charge, and how much could they make?

Revenue = Price × # of units sold

Let x be the # of 10 cents decrease

Price	# of shirts
\$15	40
\$14.90	42
\$14.80	44
\$14.70	46

$R = 15 \times 40$ (price, # units)

$R = (15 - 0.10x)(40 + 2x)$

$= 600 + 30x - 4x - 0.2x^2$

$= -0.2x^2 + 26x + 600$

$= -0.2(x^2 - 130x) + 600$

$= -0.2\left[x^2 - 130x + \left(\frac{-130}{2}\right)^2 - \left(\frac{-130}{2}\right)^2\right] + 600$ ($a = x$, $b = -65$)

$= -0.2(x-65)^2 + 600 + (-4225 \times -0.2)$

$R = -0.2(x-65)^2 + 1445$

∴ Vertex = (65, 1445)

x value of ver

∴ Price = $(15 - 0.1 \cdot 65)$

Price = 8.5

∴ Max revenue is \$1445 at \$8.50.

Example 3 A ferry operator takes tourists to an island. The operator carries an average of 500 people per day for $20. The operator estimates that for each $1 increase in fare, 20 fewer people will take the trip. Let x be the number of $1 price increases. What is the operator's maximum revenue, and what price should he charge?

Price	# of people
20	500
21	480
22	460

Let x be # of $1 increase

// R // revenue

$R = 20 \times 500$

(20 = Unit price, 500 = Units sold)

$R = (20+x)(500-20x)$

$R = 10{,}000 - 400x + 500x - 20x^2$

$R = -20x^2 + 100x + 10{,}000$

$R = -20(x^2 - 5x) + 10{,}000$

$R = -20\left[x^2 - 5x + \left(\frac{-5}{2}\right)^2 - \left(\frac{-5}{2}\right)^2\right] + 10{,}000$

$a = x$ $\quad b = -2.5$

$R = -20\left[(x-2.5)^2 - 6.25\right]$

$R = -20(x-2.5)^2 + 10{,}000 + (-6.25x$

$R = -20(x-2.5)^2 + 10125$

∴ Vertex = $(2.5, 1$

∴ The max revenue i

10,125 at $22.

$20 + 2.5 = 2$

Example 4 A computer company selling game consoles sells 100 consoles in the average week at a price of $200 each. They find that for every $10 price decrease, 5 more consoles would be sold. If each console costs $50 to make, what should the selling price be in order to maximize profit?

* Profit = Revenue − Cost

= (Unit price × Quantity) − (Unit cost × Quantity)

$Y \rightarrow$ Profit = $(200 \times 100) - (50 \times 100)$

* Let x be # of 10 $ decrease

Price	Quantity
200$	100
190	105
180	110

Profit = $(200 - 10x)(100 + 5x) - (50(100+5x$

Profit = $20{,}000 + 1000x - 1000x - 50x^2 - (5000 +$

Profit = $20{,}000 + 0 - 50x^2 - 5000 - 250x$

Profit = $-50x^2 - 250x + 15000$

$= -50(x^2 + 5x) + 15000$

$= -50\left(x^2 + 5x + \left(\frac{5}{2}\right)^2 - \left(\frac{5}{2}\right)^2\right) + 15000$

$= -50(x+2.5)^2 + 15000 + (-50x - 2.5)$

$= -50(x+2.5)^2 + 15125$

∴ Vertex = $(-2.5, 15125)$

∴ The max profit is 15125 at $225

$200 - 10(-2.5) = 225$

Homework: Maximum/Minimum Application Problems - Money/Revenue Questions