Warm Up

Mathematical Modelling: Book 3

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#6 and #7

Solutions:

6. a) Max. Revenue is $4500 after 10 weeks
   b) Revenue will be 0 after 40 weeks

7. The bus will pass safely under the arch

#6) Revenue = (# of kg of Peaches)(Selling Price)

Let x Rep. # of weeks

$*R=(100+5x)(0.40-0.01x)$

$R=-0.05x^2+1x+40$

$R=-0.05(x^2-20x+100)+40+5$

$=-0.05(x-10)^2+45$

$V(10, 45)$

(x, R)

(a) Max. Rev. = $45

(b) $0=-0.05(x-10)^2+45$

$R=(100+5x)(40-1x)$

$0=(100+5x)(40-x)$

$x=-20$ $x=40$ weeks

$\frac{-45}{-0.05}=\frac{-0.05(x-10)^2}{-0.05}$

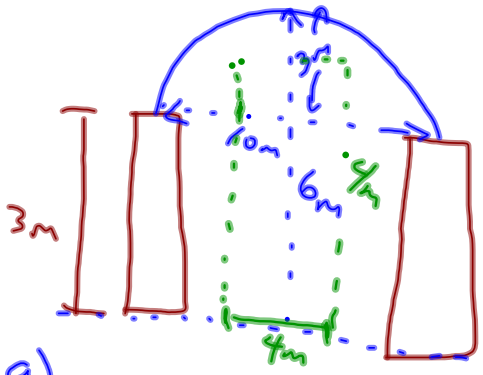
$\sqrt{900}=\sqrt{(x-10)^2}$

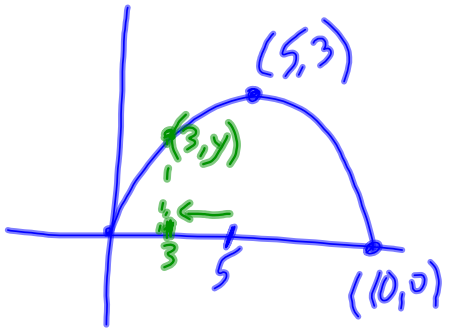
$\pm 30=x-10$

$x=10\pm 30$

$x=40$ or -20

#7)





$y = a(x-h)^2 + k$

$0 = a(0-5)^2 + 3$

$\frac{-3}{25} = a$

a) $y = \frac{-3}{25}(x-5)^2 + 3$

b) at $x = 3$

$y = \frac{-3}{25}(3-5)^2 + 3$

$y = \frac{-12}{25} + 3$

$y = \frac{63}{25} = 2.52\text{ m}$

Would have $2.52\text{m} + 3\text{m}$

$= 5.52\text{m}$ of clearance

Solving by completing the Square (Finding x-intercepts)

EXAMPLE:

Determine the x-intercepts of the following...

$$y = x^2 + 4x + 1$$

$0 = x^2 + 4x + 1$

Complete square ...

$0 = (x^2 + 4x + 4) - 4 + 1$

$0 = (x+2)^2 - 3$

$\sqrt{3} = \sqrt{(x+2)^2}$

$\pm\sqrt{3} = x + 2$

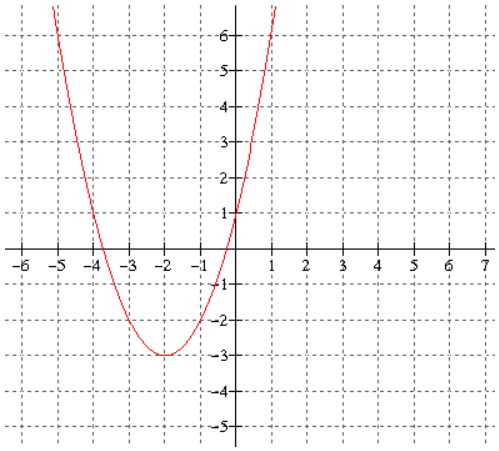
$x = -2 \pm \sqrt{3}$

$x = -2 + \sqrt{3}$ OR $x = -2 - \sqrt{3}$

$x \doteq -0.27$ $\quad$ $x \doteq -3.7$

if $x^2 = 25$, then $x = \pm 5$

Note



EXAMPLE

$y = x^2 + 6x - 7$

Find x-intercepts by:
1. Factoring by inspection
2. Factoring by completing the square

Solution

$0 = x^2 + 6x - 7$

$0 = (x+7)(x-1)$

$x = -7$ or $x = 1$

$0 = x^2 + 6x - 7$

$0 = (x^2 + 6x + 9) - 9 - 7$

$\sqrt{16} = \sqrt{(x+3)^2}$

$\pm 4 = x + 3$

$x = -3 \pm 4$

$x = 1$ or $x = -7$

EXAMPLE #3 - What is happening if the left side is negative?

$$y = -2(x - 5)^2 - 4$$

$0 = -2(x-5)^2 - 4$

$\frac{4}{-2} = \frac{-2(x-5)^2}{-2}$

$-2 = \sqrt{(x-5)^2}$

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