Last day's work: pp. 300-301 #3bce, 4c, 6, 9bd
p. 300 (top) #C2
***Enrichment*:** p. 302 #14

2 day's ago:
p. 300 #1*, 2*
1f 2a

Today's Learning Goal(s):

By the end of the class, I will be able to:

a) solve problems involving quadratic equations.

Quiz 1st

on next slide →

p.300 1f) $16x^2+24x=-9$

$$16x^2+24x+9=0$$

$$a=16 \quad b=24 \quad c=9$$

$$x=\frac{-(24)\pm\sqrt{(24)^2-4(16)(9)}}{2(16)}$$

$$=\frac{-24\pm\sqrt{0}}{32} \longleftarrow \text{discriminant}: b^2-4ac$$

$$=\frac{-24}{32}$$

$$=\frac{-3}{4}$$

$$16x^2+24x+9=0$$

$$(4x+3)^2=0$$

$$\therefore 4x+3=0$$

$$4x=^-3$$

$$x=\frac{^-3}{4}$$

p. 300

2a) $3x^2 + 14x + 5 = 0$

$a = 3 \quad b = 14 \quad c = 5$

$$x = \frac{-(14) \pm \sqrt{(14)^2 - 4(3)(5)}}{2(3)}$$

$$= \frac{-14 \pm \sqrt{136}}{6}$$ ← Exact roots. (but not simplified fully)

$$x = \frac{-14 + \sqrt{136}}{6} \text{ or } x = \frac{-14 - \sqrt{136}}{6}$$

$\doteq -0.389 \qquad \doteq -4.276$

$\underbrace{\doteq -0.39 \qquad \doteq -4.28}_{\text{Approximate Roots}}$

$$x = \frac{-14 \pm \sqrt{136}}{6}$$

$$= \frac{-14 \pm \sqrt{4}\sqrt{34}}{6}$$

$$= \frac{-14 \pm 2\sqrt{34}}{6}$$

$$= \frac{\cancel{2}^{1}(-7 \pm \sqrt{34})}{\cancel{6}_{3}}$$

Book Answer for simplified $= \frac{-7 \pm \sqrt{34}}{3}$

MPM 2DI Quadratic Equations
Show What You Know 6.1

5 Marks

Name: ____________________

By "completing the square", rewrite each relation in vertex form, then **STATE the vertex for each parabola**.

a) $y = x^2 + 8x + 13$

b)

a)

b) $y = -2x^2 + 20x - 41$

a)

b)

Don't forget to STATE the vertex for each parabola

$\therefore v(\quad , \quad)$ $\therefore v(\quad , \quad)$

$y = x^2 + 8x + 13$

$= \underline{x^2 + 8x + 16} - 16 + 13$

$= (x+4)^2 - 3$

$\therefore V(-4,-3)$

$y = -2x^2 + 20x - 41$

$= -2(x^2 - 10x) - 41$

$= -2(\underbrace{x^2 - 10x + 25} - 25) - 41$

$= -2(x-5)^2 + 50 - 41$

$= -2(x-5)^2 + 9$

$\therefore V(5,9)$

Old Solutions:

p.300 3b) $y = 2x^2 - 5x - 12$

x-int, let $y = 0$

$0 = 2x^2 - 5x - 12$

$0 = (2x+3)(x-4)$

$\therefore x = \frac{-3}{2}$ or $x = 4$

$(= -1.5)$

$x = \frac{-b}{2a}$

$= \frac{-(-5)}{2(2)}$

$= \frac{5}{4}$

$(= 1.25)$

$y = (2x+3)(x-4)$

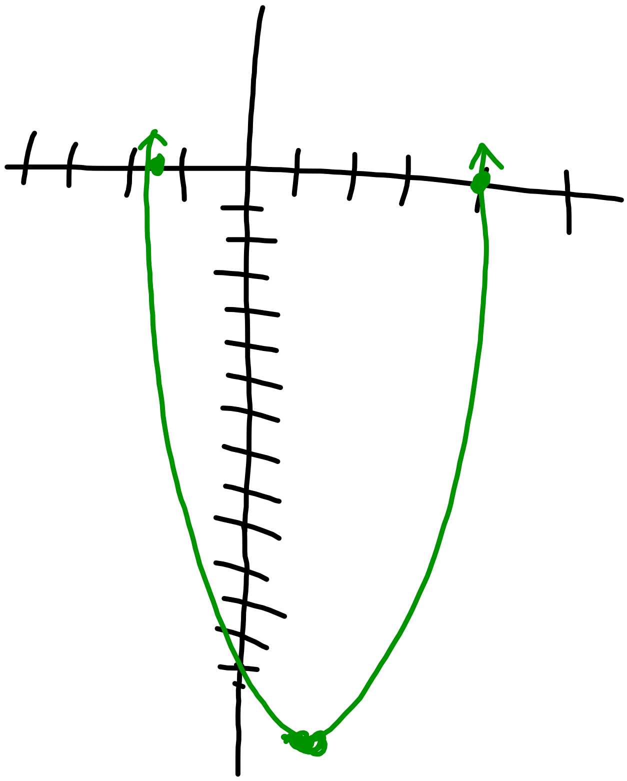
$= \left(\cancel{2}^{1}\left(\frac{5}{\cancel{4}_{2}}\right)+3\right)\left(\frac{5}{4} - 4\right)$

$= \left(\frac{5}{2} + \frac{6}{2}\right)\left(\frac{5}{4} - \frac{16}{4}\right)$

$= \left(\frac{11}{2}\right)\left(-\frac{11}{4}\right)$

$= \frac{-121}{8}$

$(= -15.125)$



Old Solutions:

p.300

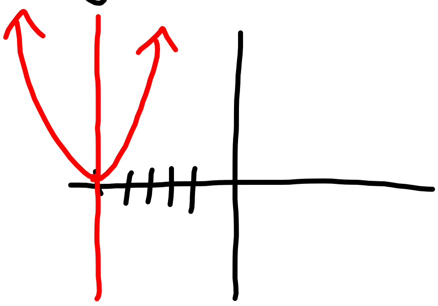
3c) $y = x^2 + 10x + 25$

$= (x+5)^2$

$\therefore V(-5, 0)$

x-int = -5

A of S: $x = -5$



$x = -5$

3e) $y = x^2 - 2x + 3$

x-int, let $y = 0$

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

$a = 1 \quad b = -2 \quad c = 3$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(3)}}{2(1)}$$

$$= \frac{2 \pm \sqrt{4 - 12}}{2}$$

$$= \frac{2 \pm \sqrt{-8}}{2}$$

$\therefore$ No Real roots

$\therefore$ no x-intercepts

A of S:

$$x = \frac{-b}{2a}$$

$$= \frac{-(-2)}{2(1)}$$

$$= \frac{2}{2}$$

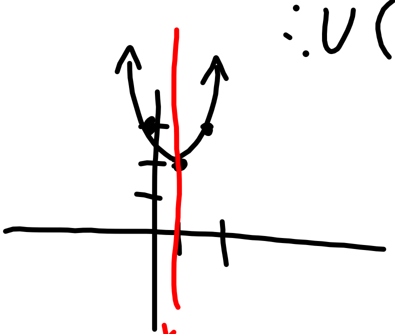
$$= 1$$

$y = (1)^2 - 2(1) + 3$

$= 1 - 2 + 3$

$= 2$

$\therefore V(1, 2)$



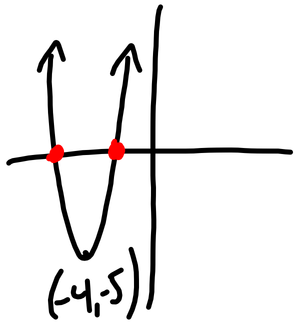
$x = 1$

p.300 4c) $y = 2(x+4)^2 - 5$

$\therefore V(-4,-5)$ opens up

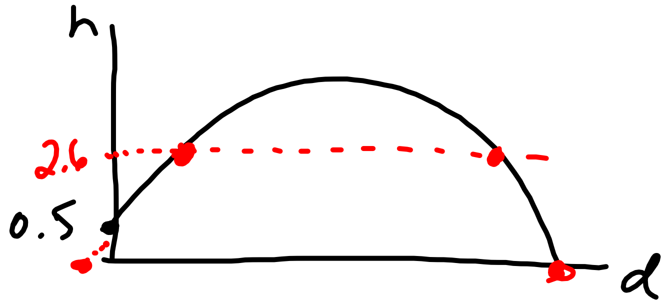
$\therefore$ 2 x-intercepts

Why? quick sketch



p. 301 #6

Old Solutions:



For help with question 6, see Example 4.

6. The path of a soccer ball after it is kicked from a height of 0.5 m above the ground is given by the equation $h = -0.1d^2 + d + 0.5$, where h is the height, in metres, above the ground and d is the horizontal distance, in metres.

a) How far has the soccer ball travelled horizontally, to the nearest tenth of a metre, when it lands on the ground?

b) Find the horizontal distance when the soccer ball is at a height of 2.6 m above the ground.

a) ball lands when $h=0$

$0 = -0.1d^2 + d + 0.5$

$\therefore a = -0.1 \quad b = 1 \quad c = 0.5$

$$d = \frac{-(1) \pm \sqrt{(1)^2 - 4(-0.1)(0.5)}}{2(-0.1)}$$

$$= \frac{-1 \pm \sqrt{1 + 0.2}}{-0.2}$$

$d = \frac{-1 + \sqrt{1.2}}{-0.2}$ or $d = \frac{-1 - \sqrt{1.2}}{-0.2}$

$\doteq -0.477$ inadmissible $\qquad \doteq 10.47$

$\doteq 10.5$ m

$\therefore$ the ball travels 10.5 m horizontally.

b) let $h = 2.6$

$2.6 = -0.1d^2 + d + 0.5$

$0 = -0.1d^2 + d + 0.5 - 2.6$

$0 = -0.1d^2 + d - 2.1$

$\therefore a = -0.1 \quad b = 1 \quad c = -2.1$

$$d = \frac{-(1) \pm \sqrt{(1)^2 - 4(-0.1)(-2.1)}}{2(-0.1)}$$

$$= \frac{-1 \pm \sqrt{1 - 0.84}}{-0.2}$$

$$= \frac{-1 \pm \sqrt{0.16}}{-0.2}$$

$d = \frac{-1 + 0.4}{-0.2}$ or $d = \frac{-1 - 0.4}{-0.2}$

$= 3$ up $\qquad = 7$ down.

p.301

Old Solutions:

9b) $4x^2 = 12 - 13x$

$4x^2 + 13x - 12 = 0$

$a = 4 \quad b = 13 \quad c = -12$

$x = \dfrac{-(13) \pm \sqrt{(13)^2 - 4(4)(-12)}}{2(4)}$

$= \dfrac{-13 \pm \sqrt{169 + 192}}{8}$

$= \dfrac{-13 \pm \sqrt{361}}{8}$

$x = \dfrac{-13 + 19}{8}$ or $x = \dfrac{-13 - 19}{8}$

$= \dfrac{6}{8} \qquad = \dfrac{-32}{8}$

$= 0.75 \qquad = -4$

d) $x(3x - 8) = -1$

$3x^2 - 8x + 1 = 0$

$a = 3 \quad b = -8 \quad c = 1$

$x = \dfrac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(1)}}{2(3)}$

$= \dfrac{8 \pm \sqrt{64 - 12}}{6}$

$= \dfrac{8 \pm \sqrt{52}}{6}$

$x = \dfrac{8 + \sqrt{52}}{6}$ or $x = \dfrac{8 - \sqrt{52}}{6}$

$\doteq 2.535 \qquad \doteq 0.131$

$\doteq 2.54 \qquad \doteq 0.13$

3UI Expectation:

$= \dfrac{8 \pm \sqrt{52}}{6}$

$x = \dfrac{8 + \sqrt{52}}{6}$ or $x = \dfrac{8 - \sqrt{52}}{6}$

$= \dfrac{8 + \sqrt{4}\sqrt{13}}{6}$

$= \dfrac{\cancel{8}^{4} + \cancel{2}^{1}\sqrt{13}}{\cancel{6}_{3}}$

$= \dfrac{4 + \sqrt{13}}{3}$

Old Solutions:

C2 After using the quadratic formula, explain how you would know if a quadratic equation has

a) two real roots

b) one real root

c) no real roots

a) two real roots

most common

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

b) one real root

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$b^2-4ac=0$

c) No real roots

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

if $b^2-4ac < 0$

negative

MPM 2DI

6.5 Solve Problems Using Quadratic Equations (Day1)

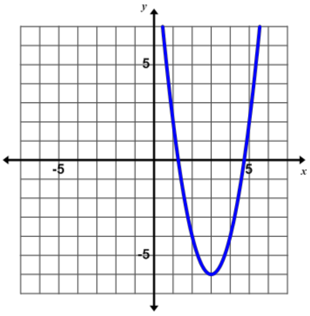
Date: May 17/16

Recall: For any quadratic relation $y = ax^2 + bx + c$

To find the x-intercepts (or zeros).

- Let $y = 0$.
  $0 = ax^2 + bx + c$
- Now use the quadratic (root) formula.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



To find the vertex or
to find the maximum or minimum.

- Complete the square.

or

- Find the axis of symmetry.

$$x = \frac{-b}{2a}$$

- Now substitute x into the relation to find y, the max./min. value.

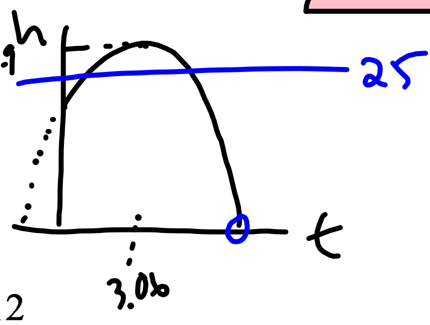
Ex. 1 Max punts a football off the roof of the school.
It's height, h, in metres is given by $h = -4.9t^2 + 30t + 12$, where t, is the time in seconds.

a) What is the height of the school? $a = -4.9 \quad b = 30 \quad c = 12$

b) What is the maximum height reached by the ball and when does it reach it? (Use 2 decimal places.)

c) When does the football hit the ground? (Use 2 decimal places.)

d) When is the football 25 m above the ground? (Use 2 decimal places.)



a) Max is still holding the football when t=0,
the height of the school is 12 m.

b) The maximum height occurs at the vertex.

$$t = \frac{-b}{2a}$$
$$= \frac{-(30)}{2(-4.9)}$$
$$= \frac{-30}{-9.8}$$
$$\doteq 3.061$$
$$\doteq 3.06 \text{ sec}$$

$$t \doteq 3.06 \text{ sec}$$
$$h \doteq -4.9(3.06)^2 + 30(3.06) + 12$$
$$\doteq 57.918$$
$$\doteq 57.92\,m$$

the maximum height is __57.92__ m,
and occurs at __3.06__ s.

c) The football is on the ground when h=0,

$$\therefore 0 = -4.9t^2 + 30t + 12$$

a = -4.9 b = 30 c = 12

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-(30) \pm \sqrt{(30)^2 - 4(-4.9)(12)}}{2(-4.9)}$$
$$= \frac{-30 \pm \sqrt{1135.2}}{-9.8}$$

$$\therefore t \doteq -0.376$$

inadmissible
(time must be positive)

$$\therefore t \doteq 6.499$$
$$\doteq 6.50\ s$$

the football hits the ground at 6.5 s.

d) Let h = 25

$$\therefore 25 = -4.9t^2 + 30t + 12$$
$$0 = -4.9t^2 + 30t + 12 - 25$$
$$0 = -4.9t^2 + 30t - 13$$

a = -4.9 b = 30 c = -13

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-(30) \pm \sqrt{(30)^2 - 4(-4.9)(-13)}}{2(-4.9)}$$
$$= \frac{-30 \pm \sqrt{645.2}}{-9.8}$$

$$\therefore t \doteq 0.469 \qquad \therefore t \doteq 5.653$$
$$\doteq 0.47\ s \qquad \doteq 5.65\ s$$

the ball is 25 m above the ground
at 0.47 s on the way up,
and 5.65 s on the way down.

Ex. 2 The product of two consecutive odd integers is 143. Find the integers.

Let x represent the first consecutive ***odd*** number.
Let $x+2$ represent the second consecutive ***odd*** number.
(must be 2 numbers apart)

$$1ST \times 2nd = 143$$
$$x(x+2) = 143$$
$$x^2+2x = 143$$
$$x^2+2x-143 = 0$$
$$(x+13)(x-11) = 0$$

$\therefore x = -13$ or $x = 11$

if $x = -13$
$\therefore x+2$
$= -13+2$
$= -11$
$\therefore$ the consecutive odd numbers are -13 & -11

if $x = 11$, $x+2 = 13$
$\therefore$ the consecutive odd numbers are 11 & 13.

Today's entertainment: pp. 312-313 #4, 5, 6, 9, 11, 13,
***Enrichment*:** pp. 455-457 #39, 41, 54, 53a

Extra time?
Correct Unit 5 Summative.

Extra time?
Show the development of the Quadratic Formula by Completing the Square?

$$ax^2 + bx + c = 0$$

More?

Attachments

PopGoestheWeasel.mid