SOLVING QUADRATIC EQUATIONS BY COMPLETING THE SQUARE Pre-Calculus 11

You can solve quadratic equations by isolating the squared term and taking the square root of both sides.

$x^2 = 9$

$\sqrt{x^2} = \pm\sqrt{9}$

$x = \pm 3$

$x = 3, x = -3$

$(x-1)^2 - 49 = 0$

$+49 \quad +49$

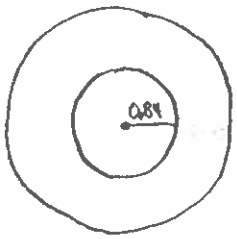
$\sqrt{(x-1)^2} = \pm\sqrt{49}$

$x - 1 = \pm 7$

$x = 1 \pm 7$

$x = 8 \quad x = -6$

Ex 1) The circular Canadian two-dollar coin consists of an aluminum and bronze core and a nickel outer ring. If the radius of the inner core is 0.84 cm and the area of the circular face of the coin is $1.96\pi\ cm^2$, what is the width of the outer ring?



$A = \pi r^2$

$\frac{1.96\pi}{\pi} = \frac{\pi r^2}{\pi}$

$\pm\sqrt{1.96} = \sqrt{r^2}$

$\pm 1.4 = r$

$-1.4 = r \rightarrow$ extraneous root.
radius cannot be negative.

$1.4 - 0.84 = \boxed{0.56\ cm}$

Ex 2) Solve $p^2 - 4p = 11$ by completing the square. Express your answers to the nearest tenth.

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

$(p^2 - 4p) = 11$

$(p^2 - 4p + 4 - 4) = 11$

$(p^2 - 4p + 4) - 4 = 11$

$(p-2)^2 - 4 = 11$

$+4 \quad +4$

$\sqrt{(p-2)^2} = \pm\sqrt{15}$

$p - 2 = \pm\sqrt{15}$

$+2 \quad +2$

$p = 2 \pm \sqrt{15}$

$p = 2 + \sqrt{15}$

$\boxed{p = 5.9}$

$p = 2 - \sqrt{15}$

$\boxed{p = -1.9}$

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Ex 2) Solve $p^2 - 4p = 11$ by completing the square. Express your answers to the nearest tenth.

Ex 3) Determine the roots of the equation $-2x^2 - 5x + 2 = 0$, to the nearest hundredth. Verify your solutions using technology.

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

$-2x^2 - 5x = -2$

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

$\frac{5}{2}(\frac{1}{2}) = (\frac{5}{4})^2 = \frac{25}{16}$

$-2(x^2 + \frac{5}{2}x + \frac{25}{16} - \frac{25}{16}) = -2$

$-2(x^2 + \frac{5}{2}x + \frac{25}{16}) + \frac{25}{8} = -2$

$-2(x + \frac{5}{4})^2 + \frac{25}{8} - \frac{25}{8} = -2 - \frac{25}{8}$

$-2(x + \frac{5}{4})^2 = \frac{-16}{8} - \frac{25}{8}$

$\frac{-2}{-2}(x + \frac{5}{4})^2 = \frac{-41}{8} \times \frac{1}{-2}$

$\sqrt{(x + \frac{5}{4})^2} = \sqrt{\frac{-41}{-16}}$

$x + \frac{5}{4} - \frac{5}{4} = \frac{-5}{4} \pm \sqrt{\frac{41}{16}}$

$x = \frac{-5}{4} + \sqrt{\frac{41}{16}}$

$x = \frac{-5}{4} - \sqrt{\frac{41}{16}}$

-6.41

-4	-5
$-4x1$	$-4+1 = -3$
$4x-1$	$4+(-1) = 3$

Ex 4) A defender kicks a soccer ball away from her own goal. The path of the kicked soccer ball can be approximated by the quadratic function $h(x) = -0.06x^2 + 3.128x - 35.34$, where x is the horizontal distance travelled, in metres, from the goal line and h is the height, in metres.

a) How far is the soccer ball from the goal line when it is kicked? Express your answer to the nearest tenth of a metre.

$h = -0.06x^2 + 3.128x - 35.34$

$-0.06x^2 + 3.128x - 35.34 = 0$

$-0.06(x^2 - 52.1x) - 35.34 = 0$

$-0.06(x^2 - 52.1x + 678.6 - 678.6) = 35.34$

$-0.06(x - 26.05)^2 + 40.7 = 35.34$

$\frac{-0.06(x - 26.05)^2}{-0.06} = \frac{-5.376}{-0.06}$

$\sqrt{(x - 26.05)^2} = \pm\sqrt{89.6}$

$x - 26.05 = \pm\sqrt{89.6}$

$x = 26.05 + \sqrt{89.6}$ $\quad x = 26.05 - \sqrt{89.6}$

$x = 35.5\text{ m}$ $\quad x = 16.6\text{m}$

b) How far does the soccer ball travel before it hits the ground?

$35.5 - 16.6 = 18.9\text{m}$

Pg. 240 # 3, 4, 6, 8, 9, 11, 13, 14