Author: Trinuha Akilathasan

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Chapter 2 - 2.2

① a) $x^2 + 2x$
$b = 2 \quad b/2 = 1$
$(x+1)^2 - 1$

b) $x^2 - 8x$
$b = -8 \quad b/2 = -4$
$(x-4)^2 - 16$

c) $x^2 - 12x$
$b = -12 \quad b/2 = -6$
$(x-6)^2 - 36$

② a) $x^2 - 8x + 12$
$x^2 - 8x \rightarrow (x-4)^2 - 16$
$(x-4)^2 - 16 + 12$
$(x-4)^2 - 4$

b) $x^2 - x - 12$
$x^2 - x \rightarrow (x - 1/2)^2 - 1/4$
$(x - 1/2)^2 - 1/4 - 12 = (x-1/2)^2 - 49/4$
$(x - 1/2)^2 - 49/4$

c) $x^2 - 3x - 4$
$x^2 - 3x \quad (x - 3/2)^2 - 9/4$
$(x - 3/2)^2 - 9/4 - 4$
$= (x - 3/2)^2 - 25/4$

③ a) $3x^2 - 12x + 17$
$3(x^2 - 4x) + 17$
$3((x-2)^2 - 4) + 17$
$= 3(x-2)^2 + 5$

b) $5(x^2 - 2x) + 12$
$5(x^2 - 2x + 1 - 1) + 12$
$= 5((x-1)^2 - 1) + 12$
$5(x-1)^2 - 5 + 12$
$= 5(x-1)^2 + 7$

c) $3x^2 - 7x + 2$
$3(x^2 - 7/3\,x) + 2$
$3(x^2 - 7/3\,x + 49/36 - 49/36) + 2$
$= 3((x - 7/6)^2 - 49/36) + 2$
$= 3(x - 7/6)^2 - 49/12 + 24/12$
$= 3(x - 7/6)^2 - 25/12$

④ a) $x^2 - 2x - 10 = 0$
$x^2 - 2x = 10$
$(x-1)^2 - 1 = 10$
$(x-1)^2 = 11$
$x - 1 = \pm\sqrt{11}$
$x = 1 \pm \sqrt{11}$

b) $5x^2 + 12x + 6 = 0$
$x^2 + 12/5\,x + 6/5 = 0$
$x^2 + 12/5\,x = -6/5$
$(x + 6/5)^2 = -6/5 + 36/25 = 6/25$
$x + 6/5 = \pm\sqrt{6}/5$
$x = -\frac{6}{5} \pm \frac{\sqrt{6}}{5}$
$x = \frac{-6 \pm \sqrt{6}}{5}$

c) $3x^2 - 7x - 2 = 0$
$x^2 - 7/3\,x - 2/3 = 0$
$x^2 - 7/3\,x = 2/3$
$(x - 7/6)^2 - \frac{49}{36} = \frac{2}{3}$
$(x - 7/6)^2 = 2/3 + 49/36$
$24/36 + 49/36 = 73/36$
$x - 7/6 = \pm\sqrt{73}/6$
$x = \frac{7 \pm \sqrt{73}}{6}$

⑤ a) $f(x) = x^2 - 7x - 2$
$(x-a)^2 - b$
$f(x) = (x - 7/2)^2 - 49/4 - 2$
$= (x - 7/2)^2 - 57/4$
$= (x - 3.5)^2 - 14.25$

b) minimum value occurs at $-b$
minimum value $= -\frac{57}{4}$
$= -14.25$

⑥ a) $n(x) = 4 - 2x - 3x^2$
$n(x) = -3x^2 - 2x + 4$
$n(x) = -3(x^2 + 2/3\,x) + 4$
$(1/3)^2 = 1/9$
$n(x) = -3(x^2 + 2/3\,x + 1/9 - 1/9) + 4$
$n(x) = -3((x + 1/3)^2 - 1/9) + 4$
$n(x) = -3(x + 1/3)^2 + 1/3 + 4$
$n(x) = -3(x + 1/3)^2 + 13/3$
$(x + 1/3)^2 + 13/3 = c$
$a = -3 \quad b = 1/3 \quad c = 13/3$

b) $n(x) = 0 \quad -3(x + 1/3)^2 + 13/3 = 0$
$-3(x + 1/3)^2 - 13/3 = (x + 1/3)^2 = 13/9$
$x + 1/3 = \pm\sqrt{\frac{13}{9}} \quad x + \frac{1}{3} = \pm\frac{\sqrt{13}}{3}$
$x = -\frac{1}{3} \pm \frac{\sqrt{13}}{3}$
$x = \frac{-1 \pm \sqrt{13}}{3}$

⑦ a) $6x - 2 - x^2 \longrightarrow -(x^2 - 6x + 2)$
$(-6/2)^2 = 9 \quad = -(x^2 - 6x + 2) = -((x-3)^2 - 7)$
$= -(x-3)^2 + 7$
$-(x-3)^2 + 7 = 7 - (x-3)^2$
$p = -3$
$q = 7 \qquad 7 - (x-3)^2$

b) $6x - 2 - x^2 = 0$
$6x - 2 - x^2 = -(x-3)^2 + 7$
$-(x-3)^2 + 7 = 0 \rightarrow -(x-3)^2 = -7$
$(x-3)^2 = 7$
$x - 3 = \pm\sqrt{7}$
$x = 3 \pm \sqrt{7}$