4.4 Pre-Calculus Math11

Page 254 # 2-5 (do at least 3 of each), 7-9

2. a) $f(x) = x^2 - 2x - 14$

use the discriminant $b^2 - 4ac$

$a = 1$, $b = -2$, $c = -14$

$(-2)^2 - 4(1)(-14)$

$4 + 56$

60

positive, so 2 zeros

b) $g(x) = -3x^2 + 0.06x + 4$

$a = -3$, $b = 0.06$, $c = 4$

$(0.06)^2 - 4(-3)(4)$

$0.0036 + 48$

48.0036

positive, so 2 zeros

c) $f(x) = \frac{1}{4}x^2 - 3x + 9$

$a = \frac{1}{4}$, $b = -3$, $c = 9$

$(-3)^2 - \cancel{4}\left(\frac{1}{\cancel{4}}\right)(9)$

$9 - 9$

0

1 zero

d) $f(v) = -v^2 + 2v - 1$

$a = -1$, $b = 2$, $c = -1$

$2^2 - 4(-1)(-1)$

$4 - 4$

0

1 zero

e) $f(x) = \frac{1}{2}x^2 - x + \frac{5}{2}$

$a = \frac{1}{2}$, $b = -1$, $c = \frac{5}{2}$

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

$1 - 5$

-4

negative, so no zeros

f) $g(y) = -6y^2 + 5y - 1$

$a = -6$, $b = 5$, $c = -1$

$5^2 - 4(-6)(-1)$

$25 - 24$

1

positive, so 2 zeros

3. use $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

a) $7x^2 + 24x + 9 = 0$

$a = 7$, $b = 24$, $c = 9$

$x = \dfrac{-24 \pm \sqrt{24^2 - 4(7)(9)}}{2(7)}$

$x = \dfrac{-24 \pm \sqrt{576 - 252}}{14}$

$x = \dfrac{-24 \pm \sqrt{324}}{14}$

$x = \dfrac{-24 \pm 18}{14}$

$x = \dfrac{-24 + 18}{14}$ or $x = \dfrac{-24 - 18}{14}$

$x = \dfrac{-6}{14}$ $\quad$ $x = \dfrac{-42}{14}$

$x = -\dfrac{3}{7}$ $\quad$ $x = -3$

b) $4p^2 - 12p - 9 = 0$

$a = 4$, $b = -12$, $c = -9$

$p = \dfrac{-(-12) \pm \sqrt{(-12)^2 - 4(4)(-9)}}{2(4)}$

$p = \dfrac{12 \pm \sqrt{144 + 144}}{8}$

$288 = 144 \cdot 2$

$p = \dfrac{12 \pm \sqrt{288}}{8}$

$p = \dfrac{12 \pm \sqrt{144 \cdot 2}}{8}$

$p = \dfrac{\cancel{12}^{3} \pm \cancel{12}^{3}\sqrt{2}}{\cancel{8}_{2}}$

$p = \dfrac{3 \pm 3\sqrt{2}}{2}$

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3. c) $3q^2+5q=1$

$3q^2+5q-1=0$

$a=3$, $b=5$, $c=-1$

$q=\frac{-5\pm\sqrt{5^2-4(3)(-1)}}{2(3)}$

$q=\frac{-5\pm\sqrt{25+12}}{6}$

$q=\frac{-5\pm\sqrt{37}}{6}$

equation must be equal to zero to solve

d) $2m^2+4m-7=0$

$a=2$, $b=4$, $c=-7$

$m=\frac{-4\pm\sqrt{4^2-4(2)(-7)}}{2(2)}$

$m=\frac{-4\pm\sqrt{16+56}}{4}$

$m=\frac{-4\pm\sqrt{72}}{4}$

$m=\frac{-4\pm\sqrt{36\cdot 2}}{4}$

$m=\frac{-\cancel{4}^{2}\pm\cancel{6}^{3}\sqrt{2}}{\cancel{4}_{2}}$

$m=\frac{-2\pm3\sqrt{2}}{2}$

$\frac{-4\pm6\sqrt{2}}{4}=$

$\frac{\cancel{2}(-2\pm3\sqrt{2})}{\cancel{4}2}=$

$\frac{-2\pm3\sqrt{2}}{2}$

e) $2j^2-7j=-4$

$2j^2-7j+4=0$

$a=2$, $b=-7$, $c=4$

$j=\frac{-(-7)\pm\sqrt{(-7)^2-4(2)(4)}}{2(2)}$

$j=\frac{7\pm\sqrt{49-32}}{4}$

$j=\frac{7\pm\sqrt{17}}{4}$

f) $16g^2+24g=-9$

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

$a=16$, $b=24$, $c=9$

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

$g=\frac{-24\pm\sqrt{576-576}}{32}$

$g=\frac{-24\pm\sqrt{0}}{32}$

$g=\frac{-24}{32}=\frac{-3}{4}$

4. a) $3z^2+14z+5=0$

$a=3$, $b=14$, $c=5$

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

$z=\frac{-14\pm\sqrt{196-60}}{6}$

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

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

$z=-0.39$ $\quad$ $z=-4.28$

b) $4c^2-7c-1=0$

$a=4$, $b=-7$, $c=-1$

$c=\frac{-(-7)\pm\sqrt{(-7)^2-4(4)(-1)}}{2(4)}$

$c=\frac{7\pm\sqrt{49+16}}{8}$

$c=\frac{7\pm\sqrt{65}}{8}$

$c=\frac{7+\sqrt{65}}{8}$ or $c=\frac{7-\sqrt{65}}{8}$

$c=1.88$ $\quad$ $c=-0.13$

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4. c) $-5u^2+16u-2=0$

$a=-5$, $b=16$, $c=-2$

$$u=\frac{-16\pm\sqrt{16^2-4(-5)(-2)}}{2(-5)}$$

$$u=\frac{-16\pm\sqrt{256-40}}{-10}$$

$$u=\frac{-16\pm\sqrt{216}}{-10}$$

$$u=\frac{-16+\sqrt{216}}{-10} \quad \text{or} \quad u=\frac{-16-\sqrt{216}}{-10}$$

$u=0.13$ $\qquad$ $u=3.07$

d) $8b^2+12b=-1$

$a=8$, $b=12$, $c=1$

$8b^2+12b+1=0$

$$b=\frac{-12\pm\sqrt{12^2-4(8)(1)}}{2(8)}$$

$$b=\frac{-12\pm\sqrt{144-32}}{16}$$

$$b=\frac{-12\pm\sqrt{112}}{16}$$

$$b=\frac{-12+\sqrt{112}}{16} \quad \text{or} \quad b=\frac{-12-\sqrt{112}}{16}$$

$b=-0.09$ $\qquad$ $b=-1.41$

e) $10w^2-45w=7$

$a=10$, $b=-45$, $c=-7$

$10w^2-45w-7=0$

$$w=\frac{-(-45)\pm\sqrt{(-45)^2-4(10)(-7)}}{2(10)}$$

$$w=\frac{45\pm\sqrt{2025+280}}{20}$$

$$w=\frac{45\pm\sqrt{2305}}{20}$$

$$w=\frac{45+\sqrt{2305}}{20} \quad \text{or} \quad w=\frac{45-\sqrt{2305}}{20}$$

$w=4.65$ $\qquad$ $w=-0.15$

f) $-6k^2+17k+5=0$

$a=-6$, $b=17$, $c=5$

$$k=\frac{-17\pm\sqrt{17^2-4(-6)(5)}}{2(-6)}$$

$$k=\frac{-17\pm\sqrt{289+120}}{-12}$$

$$k=\frac{-17\pm\sqrt{409}}{-12}$$

$$k=\frac{-17+\sqrt{409}}{-12} \quad \text{or} \quad k=\frac{-17-\sqrt{409}}{-12}$$

$k=-0.27$ $\qquad$ $k=3.10$

5. a) $3x^2+6x+1=0$

$a=3$, $b=6$, $c=1$

$$x=\frac{-6\pm\sqrt{6^2-4(3)(1)}}{2(3)}$$

$$x=\frac{-6\pm\sqrt{36-12}}{6}$$

$$x=\frac{-6\pm\sqrt{24}}{6}$$

$$x=\frac{-6\pm\sqrt{4\cdot 6}}{6}$$

$$x=\frac{-\cancel{6}^{3}\pm\cancel{2}^{1}\sqrt{6}}{\cancel{6}\,3}$$

exact answer $x=\dfrac{-3\pm\sqrt{6}}{3}$

approx. answer $x=\dfrac{-3+\sqrt{6}}{3}$ or $x=\dfrac{-3-\sqrt{6}}{3}$

$x=-0.18$ $\qquad$ $x=-1.82$

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5. b) $h^2 + \frac{h}{6} - \frac{1}{2} = 0$

$6 \cdot h^2 + \cancel{6} \cdot \frac{h}{\cancel{6}} - \cancel{6}^{3} \cdot \frac{1}{\cancel{2}} = 6 \cdot 0$

$\boxed{\begin{array}{l} a=6 \\ b=1 \\ c=-3 \end{array}}$

$6h^2 + h - 3 = 0$

$h = \frac{-1 \pm \sqrt{1^2 - 4(6)(-3)}}{2(6)}$

$h = \frac{-1 \pm \sqrt{1 + 72}}{12}$

$h = \frac{-1 \pm \sqrt{73}}{12}$

$h = \frac{-1 + \sqrt{73}}{12}$ or $h = \frac{-1 - \sqrt{73}}{12}$

$h = 0.63$ $\quad$ $h = -0.80$

c) $0.2m^2 = -0.3m + 0.1$

$0.2m^2 + 0.3m - 0.1 = 0$

$\boxed{\begin{array}{l} a=0.2 \\ b=0.3 \\ c=-0.1 \end{array}}$

$m = \frac{-0.3 \pm \sqrt{(0.3)^2 - 4(0.2)(-0.1)}}{2(0.2)}$

$m = \frac{-0.3 \pm \sqrt{0.09 + 0.08}}{0.4}$

$m = \frac{-0.3 \pm \sqrt{0.17}}{0.4}$

$m = \frac{-0.3 + \sqrt{0.17}}{0.4}$ or $m = \frac{-0.3 - \sqrt{0.17}}{0.4}$

$m = 0.28$ $\quad$ $m = -1.78$

d) $4y^2 + 7 - 12y = 0$

$4y^2 - 12y + 7 = 0$

$\boxed{\begin{array}{l} a=4 \\ b=-12 \\ c=7 \end{array}}$

$y = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(4)(7)}}{2(4)}$

$y = \frac{12 \pm \sqrt{144 - 112}}{8}$

$y = \frac{12 \pm \sqrt{32}}{8}$

$y = \frac{12 + \sqrt{32}}{8}$ or $y = \frac{12 - \sqrt{32}}{8}$

$y = 2.21$ $\quad$ $y = 0.79$

e) $\frac{x}{2} + 1 = \frac{7x^2}{2}$

$\cancel{2} \cdot \frac{x}{\cancel{2}} + 2 \cdot 1 = \cancel{2} \cdot \frac{7x^2}{\cancel{2}}$

$x + 2 = 7x^2$

$\boxed{\begin{array}{l} a=7 \\ b=-1 \\ c=-2 \end{array}}$

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

$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(7)(-2)}}{2(7)}$

$x = \frac{1 \pm \sqrt{1 + 56}}{14}$

$x = \frac{1 \pm \sqrt{57}}{14}$

$x = \frac{1 + \sqrt{57}}{14}$ or $x = \frac{1 - \sqrt{57}}{14}$

$x = 0.61$ $\quad$ $x = -0.47$

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5. f) $2z^2 = 6z - 1$

$2z^2 - 6z + 1 = 0$

$a = 2$, $b = -6$, $c = 1$

$z = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(2)(1)}}{2(2)}$

$z = \frac{6 \pm \sqrt{36 - 8}}{4}$

$z = \frac{6 \pm \sqrt{28}}{4}$

$z = \frac{6 + \sqrt{28}}{4}$ or $z = \frac{6 - \sqrt{28}}{4}$

$z = 2.82$ $\quad$ $z = 0.18$

7. a) $n^2 + 2n - 2 = 0$ ← small numbers good for complete the square

$n^2 + 2n = 2$

$n^2 + 2n + 1 = 2 + 1$

$(n+1)^2 = 3$

$n + 1 = \pm\sqrt{3}$

$n = -1 \pm \sqrt{3}$

b) $-y^2 + 6y - 9 = 0$ ← divide by -1

$y^2 - 6y + 9 = 0$

$(y-3)(y-3) = 0$ can be factored

$y - 3 = 0$

$y = 3$

c) $-2u^2 + 16 = 0$ no linear term – take square root

$-2u^2 = -16$

$u^2 = 8$

$u = \pm\sqrt{8}$

$u = \pm\sqrt{4 \cdot 2}$

$u = \pm 2\sqrt{2}$

d) $\frac{x^2}{2} - \frac{x}{3} = 1$ more complicated – use quadratic formula

$\cancel{3}\cancel{6} \cdot \frac{x^2}{\cancel{2}} - \cancel{2}\cancel{6} \cdot \frac{x}{\cancel{3}} = 6 \cdot 1$

$3x^2 - 2x = 6$

$3x^2 - 2x - 6 = 0$

$a = 3$, $b = -2$, $c = -6$

$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-6)}}{2(3)}$

$x = \frac{2 \pm \sqrt{4 + 72}}{6}$

$x = \frac{2 \pm \sqrt{76}}{6}$

$x = \frac{2 \pm \sqrt{4 \cdot 19}}{6}$

$x = \frac{\cancel{2} \pm \cancel{2}\sqrt{19}}{\cancel{6}\,3}$

$x = \frac{1 \pm \sqrt{19}}{3}$

e) $x^2 - 4x + 8 = 0$

$a = 1$, $b = -4$, $c = 8$

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

$x = \frac{4 \pm \sqrt{16 - 32}}{2}$

$x = \frac{4 \pm \sqrt{-16}}{2}$

Can't take the square root of a negative number – there will be no roots

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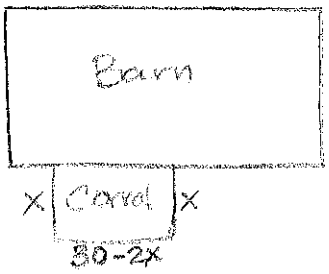
8.



30 m of fencing material
- x metres used on each end
- 30-2x metres left for the 3rd side

$A = l \cdot w$

$100 = (30-2x)x$

$100 = 30x - 2x^2$

$\frac{2x^2}{2} - \frac{30x}{2} + \frac{100}{2} = \frac{0}{2}$

$x^2 - 15x + 50 = 0$

can be easily factored
mult = 50
add = -15

$(x-5)(x-10) = 0$

$x-5=0$ or $x-10=0$

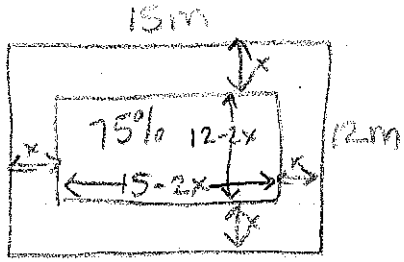
$x=5$ $\quad$ $x=10$

If x=5 (width) then
length = 30-2x
= 30-2(5)
= 30-10
= 20

If x=10 (width) then
length = 30-2(10)
= 30-20
= 10

Two possible dimensions will give an area of 100 m
5m x 20m
10m x 10m

9.



$.75(15 \times 12) = (15-2x)(12-2x)$

$135 = 180 - 30x - 24x + 4x^2$

$0 = 45 - 54x + 4x^2$

use quadratic formula or graph

a=4
b=-54
c=45

$x = \frac{-(-54) \pm \sqrt{(-54)^2 - 4(4)(45)}}{2(4)}$

$x = \frac{54 \pm \sqrt{2916 - 720}}{8}$

$x = \frac{54 \pm \sqrt{2196}}{8}$

$x = \frac{54 + \sqrt{2196}}{8}$ or $x = \frac{54 - \sqrt{2196}}{8}$

$x = 12.61$ $\quad$ $x = 0.89$

the border can't be 12.61 m because the wall is only 12m tall
The border must be 0.89 m