***Pre-Calculus 11***

***Unit 3: Solving Quadratic Equations***

***Worksheet 3.3 – Using Square Roots to Solve Quadratic Equations***

 ***(and Completing the Square)***

1. Solve each equation.

 a) $x^{2}+12=48$ b) $2x^{2}-32=0$ c) $m^{2}-7.5=92.5$

 d) $3x^{2}+2=29$ e) $10-z^{2}=4$ f) $-3=12-5d^{2}$

 g) $(y+2)^{2}=9$ h) $(3-c)^{2}-16=0$ i) $\left(m-\frac{1}{3}\right)^{2}=\frac{4}{9}$

 j) $\left(1-2g\right)^{2}=49$ k) $1.21=\left(10a+1\right)^{2}$ l) $\frac{1}{3}\left(6x-1\right)^{2}-3=0$

 m) $\frac{\left(a+2\right)^{2}}{4}=16$ n) $\left(a+\frac{3}{4}\right)^{2}=\frac{3}{16}$ o) $3\left(2x^{2}+5\right)=5\left(3x^{2}-2\right)$

 p) $\left(2n+3\right)^{2}=\left(3n+2\right)^{2}$

2. State the value of *k* that makes each expression a perfect square trinomial. Then factor it.

 a) $x^{2}+10x+k$ b) $w^{2}-14w+k$ c) $m^{2}+3m+k$

 d) $x^{2}+\frac{4}{3}x+k$ e) $d^{2}-\frac{2}{3}d+k$ f) $x^{2}-0.06x+k$

3. Solve by completing the square.

 a) $x^{2}+6x+4=0$ b) $w^{2}-4w-11=0$ c) $x^{2}+4x-12=0$

 d) $x^{2}-18x+20=0$ e) $m^{2}+7m+10=0$ f) $n^{2}-5n-6=0$

4. Solve by completing the square.

 a) $2x^{2}+8x+5=0$ b) $3d^{2}+6d+2=0$ c) $2a^{2}-12a+3=0$

 d) $5c^{2}-20c+3=0$

5. Solve by completing the square.

 a) $2x^{2}+x-5=0$ b) $2r^{2}-7r+1=0$ c) $5c^{2}-2c-6=0$

 d) $3m^{2}+5m-11=0$

6. Solve by completing the square.

 a)$ \frac{1}{2}x^{2}+x-13=0$ b) $-3m^{2}-4m+2=0$ c) $-\frac{1}{4}n^{2}-n-\frac{1}{8}=0$

 d) $1.2 x^{2}-3x-6=0$

7. The height, h metres, of a falling object is related to the time, *t* seconds, the object has been

 falling by the formula $h=-4.9t^{2}+d$

 Where *d* metres is the initial height of the object above the ground. The Bankers Hall

 building in Calgary is 196 m tall. Express the time an object takes to reach the ground from

 this height

1. as an exact number of seconds
2. to the nearest tenth of a second
3. The volume of a cone with height *h* metres and radius *r* metres is given by the formula

$v=\frac{1}{3}πr^{2}h$. What is the radius of a cone with volume $168 cm^{3}$ and height $9 cm$.

1. A triangle has a height of $6 cm$ and a base of $8 cm$. If the height and base are both decreased by the same amount, the area of the new triangle is $20 cm^{2}$. What are the base and height of the new triangle, to the nearest tenth of a centimetre?
2. The function $h\left(t\right)=-5t^{2}+20t+2$ gives the height of a thrown football as a function of the time, *t* seconds, since it was thrown. The ball hit the ground before a receiver could get near it.
3. How long was the ball in the air, to the nearest tenth of a second?
4. For how many seconds was the height of the ball at least 17m?

11. Solve each equation for $x$ by completing the square

 a) $x^{2}+2x-k=0$ b) $kx^{2}-2x=k$ c) $x^{2}=kx+1$

1. \*Find the values of $k$ that make $x^{2}+\left(k+7\right)x+\left(7k+1\right)$ a perfect square trinomial
2. \*Solve $x^{2}+bx+c=0$ for $x$ by completing the square.
3. \*\*Solve $ax^{2}+bx+c=0$ for $x$ by completing the square.

***Solutions***

1. a) $x=\pm 6$ b) $\pm 4$ c) $\pm 10$

d) $\pm 3$ e) $\pm \sqrt{6}$ f) $\pm \sqrt{3}$

g) $y=1, y=-5$ h) $c=7, c=-1$ i) $m=1, m=-\frac{1}{3}$

j) $g=-3, g=4$ k) $a=0.01, a=-0.21$ l) $x=\frac{2}{3}, x=-\frac{1}{3}$

m) $a=6, a=-10$ n) $a=\frac{\sqrt{3}-3}{4}, a=\frac{-\sqrt{3}-3}{4}$ o) $x=\pm \frac{5}{3}$

p) $n=1, n=-1$

2. a) $\left(x+5\right)^{2}$ b) $\left(w-7\right)^{2}$ c) $\left(m+\frac{3}{2}\right)^{2}$

 d) $\left(m+\frac{2}{3}\right)^{2}$ e) $\left(m-\frac{1}{3}\right)^{2}$ f) $\left(m-0.03\right)^{2}$

3. a) $x=-3\pm \sqrt{5}$ b) $w=2\pm \sqrt{15}$ c) $x=2, x=-6$

 d) $x=9\pm \sqrt{61}$ e) $m=-2, m=-5$ f) $n=6, n=-1$

4. a) $x=-2\pm \frac{\sqrt{6}}{2}$ b) $d=-1\pm \frac{\sqrt{3}}{3}$ c) $a=3\pm \frac{\sqrt{30}}{2}$ d) $c=2\pm \frac{\sqrt{85}}{5}$

5. a) $x=\frac{-1\pm \sqrt{41}}{4}$ b) $r=\frac{7\pm \sqrt{41}}{4}$ c) $c=\frac{1\pm \sqrt{31}}{5}$ d) $m=\frac{-5\pm \sqrt{157}}{6}$

6. a) $x=4.20, x=-6.20$ b) $m=0.39, m=-1.72$ c) $n=-0.13, n=-3.87$

d) $x=3.81, x=-1.31$

7. a) $\sqrt{40} seconds$ b) $6.3 seconds$

8. $radius=4.2 cm$ 9. $Base=7.5 cm; Height=5.5 cm$

10. a) $4.1 seconds$ b) $2 seconds$

11. a) $x=-1\pm \sqrt{1+k}$ b) $x=\frac{1\pm \sqrt{1-k^{2}}}{k}$ c) $x=\frac{k\pm \sqrt{k^{2}+4}}{2}$

12. $k=9, k=5$ 13. $x=\frac{-b\pm \sqrt{b^{2}-4c}}{2}$ 14. $x=\frac{-b\pm \sqrt{b^{2}-4ac}}{2a}$