Name: _____

Completing the Square

Use fractions if decimals are non-terminating. Don't round!

1. $y = -2x^2 - 4x + 70$
2. $y = -12x^2 + 12x$
3. $y = x^2 - 10x + 21$
4. $y = -x^2 - 22x + 95$
5. $y = -4x^2 + 6x - 27$
6. $y = -0.5x^2 - 8x + 1$

Completing the Square - Word Problems

7. Studies show that employees on an assembly line become more efficient as their level of training goes up. In one company, the number of products, *P*, produced per day, at a level of training of *t* hours, follows the following quadratic model: $P = -0.375t^2 + 10.25t - 8$. Determine the level/hoursof training that will give maximum productivity.

8. At the Mini Market, a s the price of milk drops, sales increase. On an average day, a 4L bag of milk costs $3.90, and the store sells an average of 120 bags. Studies have shown that for each $0.10 reduction in price, sales increase by 20 bags per day. Find what price will make the revenue maximum

BONUS

9. What is the smallest possible total of double a number and its square?

Quadratic Word Problems

Name: _____

Complete the following on a seperate piece of paper:

1. Factor each expression.

(a) $3a^2 + 6a$ (b) $2x - 8xy$ (c) $25a^2 - 9$

(d) $x^2 + 7x + 12$ (e) $y^2 - 11y + 28$ (f) $16a^2 - 8a + 1$

(g) $8 + 6x + x^2$ (h) $5b^2 - 14b + 8$ (i) $10x^2 - 28x + 16$

(j) $3d^2 - 432$ (k) $6d^2 + 5d + 1$ (l) $56c^2 + 9c - 2$

(m) $2g^2 - 2g - 24$ (n) $-16 + 9x^2$ (o) $x^2y^3z - 2xy^2$

2. A model rocket is shot into the air and its path is approximated by $h = -5t^2 + 30t$, where h is the height of the rocket above the ground in metres and t is the elapsed time in seconds.
   (a) When will the rocket hit the ground?
   (b) What is the maximum height of the rocket?

3. A baseball is thrown from the top of a building and falls to the ground below. Its path is approximated by the relation $h = -5t^2 + 5t + 30$, where h is the height above ground in metres and t is the elapsed time in seconds.
   (a) How tall is the building?
   (b) When will the ball hit the ground?
   (c) When does the ball reach its maximum height?
   (d) How high above the building is the ball at its maximum height?

4. Application: A small company that manufactures snowboards uses the relation $P = 162x - 81x^2$ to model its profit. In the model, x represents the number of snowboards in thousands, and P represents the profit in thousands of dollars.
   (a) What is the maximum profit the company can earn?
   (b) How many snowboards must it produce to earn this profit?
   (c) The company breaks even when there is neither a profit nor a loss. What are the break-even points for the company?

5. A computer software company models the profit on its latest game using the relation $P = -2x^2 + 28x - 90$, where x is the number of games it produces in hundred thousands and P is the profit in millions of dollars.
   (a) What is the maximum profit the company can earn?
   (b) How many games must it produce to earn this profit?
   (c) What are the break-even points for the company?

APPLICATIONS OF QUADRATIC RELATIONS.

1. A model rocket is shot into the air and its path is approximated by $h = -5t^2 + 30t$, where h is the height of the rocket above the ground in metres and t is the elapsed time in seconds.
   (a) When will the rocket hit the ground?
   (b) What is the maximum height of the rocket?

2. A baseball is thrown from the top of a building and falls to the ground below. Its path is approximated by the relation $h = -5t^2 + 5t + 30$, where h is the height above ground in metres and t is the elapsed time in seconds.
   (a) How tall is the building?
   (b) When will the ball hit the ground?
   (c) When does the ball reach its maximum height?
   (d) How high above the building is the ball at its maximum height?

3. A model rocket is shot straight up from the roof of a school. The height at any time t is approximated by the model $H = 15 + 23t - 5t^2$, where H is the height in metres and t is the time in seconds.
   (a) What is the height of the school?
   (b) How long does it take for the rocket to pass a window 10 m above the ground?
   (c) When does the rocket hit the ground?
   (d) What is the maximum height the rocket reaches above the roof of the school?

4. A pair of skydivers jump out of an airplane 5.5 km above the ground. The equation $H = 5500 - 5t^2$ is an approximate model for the divers' altitude in metres at t seconds after jumping out of the plane.
   (a) After 10 s how far have the divers fallen?
   (b) They open their chutes at an altitude of 1000 m. How long did they free-fall?
   (c) If a parachute does not open at 1000 m, how much time is left to use the emergency chute?

5. A professional stunt performer at a theme park dives off a tower 21 m high into the water. His height above the ground at time t seconds is given by the equation $h = -4.9t^2 + 21$.
   (a) How long does it take to reach the halfway mark?
   (b) How long does it take to reach the water?
   (c) Compare the times in (a) and (b). Explain why the time at the bottom is not twice the time at the halfway point.

6. A rock is thrown from a bridge into a river. Its height, h metres, above the river t seconds after it is released, is represented by the function $h = -4.9t^2 + 82$.
   a) Graph the function for reasonable values of t.
   b) How high is the rock after 2.5 s?
   c) When does the rock hit the water?

7. The height, h metres, of a ball t seconds after it is thrown straight up with an initial speed of 15 m/s is given by the function $h = -4.9t^2 + 15t + 75$.
   a) Graph the function.
   b) What is the maximum height of the ball?
   c) Suppose the thrower catches the ball at the same height from which it was thrown. How long is the ball in the air?

8. The path of an Acapulco cliff diver, as he dives into the sea, is given by the function $y = -2.18x^2 + 1.73x + 35$, where y metres is the diver's height above the water, and x metres is the horizontal distance travelled by the diver.
   a) Graph the function.
   b) Determine the maximum height of the diver above sea level.
   c) Assume the cliff is vertical. How far from the base of the cliff will the diver enter the water?

9. The height of a flare above the ground is a function of the time it is in the air. An equation representing the height of a flare, h metres, above the release position, after t seconds, is $h = -5t^2 + 100t$.
   a) What is the height of the flare after 3 s?
   b) What is the maximum height reached by the flare?
   c) What is the height of the flare after 25 s?
   d) Does your answer in part c make sense? Explain.
   e) Determine the time for which the flare is higher than 80 m.