Name: ______________________________ Date: ________________ Period: _____

2-15 Application Problems

WINDOW

Xmin=0

Xmax=100

Xscl=5

Ymin=0

Ymax=1200

Yscl=100

Solve with the graphing calculator

1. Suppose you are an actuary for the Drive Carefully Car Insurance Company. Your company plans to offer an accident policy and you must predict the likelihood of an accident (per 100 million kilometers driven) as a function of the driver's age. From previous records, you found that the data can be modeled by the equation $f(a) = 0.4a^2 - 36a + 1000$.

a) What is the value of the vertex of this function? Is it a maximum or a minimum? Explain the real-life interpretation of the vertex in a complete sentence.

b) Who is safer, a 16-year old driver or a 70-year old driver? Explain how you can use the calculator to come to this conclusion.

c) How many accidents would you predict a 25-year old would have? Give accurate units.

d) If Drive Carefully wants to limit their business to drivers with fewer than 250 accidents/100 million kilometers, what should be the target age group for their advertisements?

e) What is the y-intercept? Is it relevant to this situation? Why or why not? What is a reasonable domain for this situation?

Solve with the Quadratic Formula

2. The pilot of a helicopter plans to release a bucket of water on a forest fire. The height y in feet of the water t seconds after its release is modeled by $y = -16t^2 - 2t + 500$.

a) What is the y-intercept? What does it mean in this situation?

b) What will the root(s) represent in this real-life situation? Give accurate units. Find the root(s) to the nearest hundredth, showing your use of the Quadratic Formula.

$$\frac{\quad \pm \sqrt{\qquad\qquad}}{2(\qquad)}$$

c) If the horizontal distance x in feet between the water and its point of release is modeled by $x = 91t$. At what horizontal distance from the fire should the pilot start releasing the water in order to hit the target?

d) Write the equation if the helicopter is 425 feet above the fire?

Solve with the graphing calculator

3. The manager of a symphony knows that the profit, *p*, depends on the price charged per ticket, *t*, as modeled by $p(t) = -20t^2 + 1200t - 5000$.

WINDOW

Xmin=0

Xmax=70

Xscl=10

Ymin= - 6000

Ymax=15000

Yscl=1000

a) What ticket price should the symphony charge in order to maximize its profits? What is the maximum profit? What part of the graph provided this information?

b) What is the *y*-intercept? How does this apply to this real-life situation?

c) What is (are) the *x*-intercept(s)? How do you explain the *x*-intercept(s) in this situation?

d) If *a*-term is increased from -20 to -15, what happens to the symphony's profit?

Solve with the discriminant

4. Felix's Fireworks shot a rocket from a 100 foot tower with an initial velocity of 336 feet per second, which can be modeled by quadratic function $h(t) = -16t^2 + 336t + 100$, where *t* represents time and *h* represents height. Federal ordinances require that fireworks not go higher than 1800 feet in the air.

a) Write the inequality for this situation.

b) Calculate the value of the discriminant, showing your use of the discriminant. Will the fireworks be within the federal guidelines? How do you know?

c) If the guidelines allowed fireworks to reach heights of 2,000 feet, write the new inequality, find the discriminant , and explain your choice of answers.

Solve using the table on the calculator

5. The average NFL salary *A(t)* (in thousands of dollars) from 1975 – 2000 can be estimated using the functions $A(t) = 2.3t^2 - 12.4t + 73.7$, where t is the number of years since 1975.

a) Determine the domain and range for which this function makes sense.

b) According to this model, how many years after 1975 did the average salary first exceed one million dollars? Show at least 5 rows from the calculator's table to prove your answer. In what year did the average salary first exceed one million dollars?

x	y

Solve with the Quadratic Formula

6. Jim has a sheet of plywood 12 inches by 21 inches. He wants to cut equal-sized strips from each of the four sides and use the scraps to make a tray. He wants the area of the tray to be 148.75 square inches. Find the width of the strips he should cut from the four sides.

a) Write the equation. (Remember, he is cutting 2 strips from the length and 2 strips from the width.)

b) Show how you used the quadratic formula to solve the problem $\dfrac{\quad \pm\sqrt{\qquad\qquad}}{2(\qquad)}$

c) Do both answers fit the situation? Explain your answer.

d) Write your answer as a sentence using proper units.

Solve with the graphing calculator

7. A parabolic race track can be modeled with the equation $f(x) = 2x^2 - 28x + 200$, where x represents the horizontal distance from the judges' stand and y represents the vertical distance from the judges' stand. A race horse is frightened and breaks away from his trainer and runs on a course modeled by $f(x) = 16x + 56$.

WINDOW

Xmin=0

Xmax=30

Xscl=5

Ymin= 0

Ymax=600

Yscl=50

a) At what point(s) will the horse cross the race track?

b) Write a sentence describing the place(s) the horse crosses the track in relationship to the judges' stand.

Solve with the discriminant

8. Captain Hook has captured Peter Pan and imprisoned him in the crow's nest. A cannonball fired straight up can be modeled by the equation $h(t) = -16t^2 + 28t$, where h represents the height of the cannonball as a function of time. If the height of crow's is substituted for $h(t)$, what does it mean when the discriminant:

a) equals a positive number? Use complete sentences to relate the discriminant value to the situation.

b) equals a negative number? Use complete sentences to relate the discriminant value to the situation.

c) equals zero. Use complete sentences to relate the discriminant value to the situation.

9) When a baseball is thrown or hit into the air, its height h in feet after t seconds can be modeled by $h(t) = -16t^2 + v_y t + h_0$ where v_y is the initial vertical velocity of the ball in feet per second and h_0 is the ball's initial height. The horizontal distance d in feet that the ball travels in t seconds can be modeled by $d(t) = v_x t$, where v_x is the ball's initial horizontal velocity in feet per second.

a) A short stop makes an error by dropping the ball. As the ball drops, its height h in feet is modeled by $h(t) = -16t^2 + 3$. A slow-motion replay of the error shows the play at half speed. What function describes the height of the ball in the replay?

b) A player hits a foul ball with an initial vertical of 70 ft/s and an initial height of 5 ft. To the nearest foot, what is the maximum height reached by the ball?

c) A player throws the ball home from a height of 5.5 ft. with an initial vertical velocity of 28 ft/s. The ball is caught at home plate (a distance of 60 feet 6 inches from the mound to the plate) at a height of 5 ft. Three seconds before the ball is thrown, a runner on third base starts toward home plate (a distance of 90 feet from 3rd base to home) at an average speed of 25 ft/s. Does the runner reach home plate before the ball does? Explain.