Precalculus P.1 & P.2 – Calculator Name _____

1. (a) Use a calculator to complete the table.

n	1	.1	.01	.001	.0001	.00001
$5/n$						

(b) Use the result from part (a) to make a conjecture about the value of $5/n$ as n approaches zero.

2. (a) Use a calculator to complete the table.

n	1	10	100	1000	10,000	100,000
$5/n$						

(b) Use the result from part (a) to make a conjecture about the value of $5/n$ as n increases without bound.

3. *Mathematical Modeling.* A funnel is filled with water to a height of h centimeters. The time t (in seconds) for the funnel to empty is

$t = .03\left[12^{5/2} - (12-h)^{5/2}\right]$, $0 \le h \le 12$.

Find the time it takes for the funnel to empty when the water is initially filled to a height of 7 centimeters.

4. *Speed of Light.* The speed of light is 11,160,000 miles per minute. The distance from the Sun to the Earth is 92,960,000 miles. The distance from the Sun to Pluto is 3,676,000,000 miles. Find the time for light to travel from the Sun to the Earth. Find the time for light to travel from the Sun to Pluto.

Precalculus P.3 – Calculator Name _____

1. *Business*. An artist can produce and sell x craft items per month. The total cost (in dollars) for producing x craft items is $C = 460 + 12x$ and the total revenue (in dollars) is $R = 36x$.

   (a) Find the profit P obtained by selling x craft items per month (Write a polynomial).

   (b) Evaluate the polynomial for the values x in the table.

x	0	5	10	15	20	25	30	35	40
P ($)									

   (c) What do the negative values in the table represent?

   (d) When $x = 0$, what does the value for P represent?

   (e) Approximately how many craft items must the artist sell per month to make a profit?

2. *Finance.* After 2 years, an investment of $500 compounded annually at an interest rate r will yield an amount of $500(1 + r)^2$.

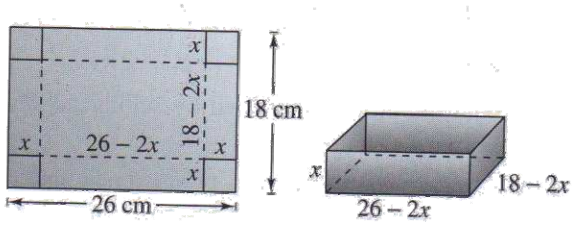
   (a) Write this polynomial in standard form.

   (b) Use a calculator to evaluate the polynomial for the values of r in the table.

r	2.5%	3%	4%	4.5%	5%
$500(1 + r)^2$ ($)					

   (c) What conclusion can you make from the table?

3. *Volume of a Box*. An open box is made by cutting squares from the corners of a piece of metal that is 18 cm by 26 cm (see figure). The edge of each cut-out square is x centimeters.



(a) Determine a polynomial in x that represents the volume of the box V.

(b) Write an inequality for x representing the values of x for which this geometry problem makes sense. Why doesn't the problem make sense for values outside this inequality?

(c) Calculate the volume of the box by evaluating the polynomial for the values of x in the table.

x (cm)	.5	1	1.5	2	2.5	3	3.5	4	4.5
V (cm^3)									

x (cm)	5	5.5	6	6.5	7	7.5	8	8.5
V (cm^3)								

(d) For approximately what value of x does the box have the maximum volume?

(e) Why would you want to express the volume of the box in terms of x instead of an actual numerical value?

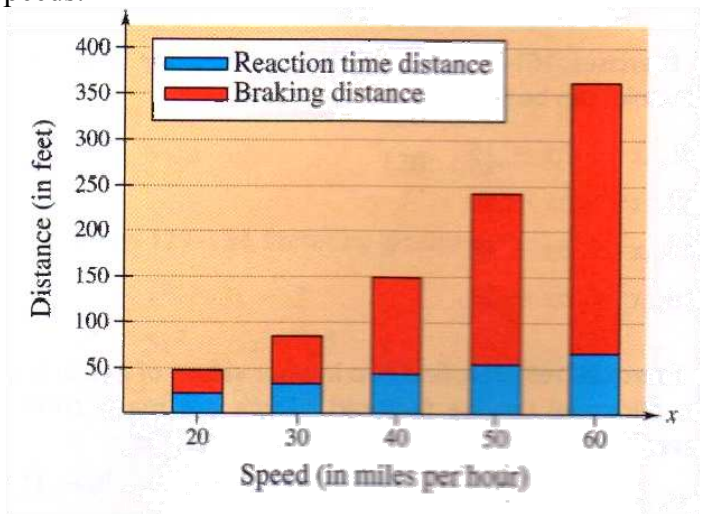
4. *Stopping Distance*. The stopping distance of an automobile is the distance traveled during the driver's reaction time plus the distance traveled after the brakes are applied. In an experiment, these distances were measured (in feet) when the automobile was traveling at a speed of x miles per hour, as shown in the bar graph. The distance traveled during the reaction time was $R = 1.1x$, and the braking distance was $B = .14x^2 - 4.43x + 58.40$.

   (a) Determine the polynomial that represents the total stopping distance T.

   (b) Use the result of part (a) to estimate the total stopping distance for the values of x in the table.

x (mph)	25	35	45	55
T (ft)				

   (c) Use the bar graph to make a statement about the total stopping distance required for increasing speeds.



Precalculus P.4 – Calculator Name _____

1. *Finance*. Use the formula that gives the approximate annual interest rate r of a monthly installment loan

$$r = \frac{\left[\frac{24(NM - P)}{N}\right]}{\left(P + \frac{NM}{12}\right)}$$

where N is the total number of payments, M is the monthly payment, and P is the amount financed.

(a) Approximate the annual interest rate for a 5-year car loan of $20,000 that has monthly payments of $400.

(b) Simplify the expression for the annual interest rate r, and then rework part (a).

2. *Refrigeration*. When food (at room temperature) is placed in a refrigerator, he time required for the food to cool depends on the amount of food, the air circulation in the refrigerator, the original temperature of the food, and the temperature of the refrigerator. Consider the model that gives the temperature of food that has an original temperature of 75°F and is placed in a 40°F refrigerator

$$T = 10\left(\frac{4t^2 + 16t + 75}{t^2 + 4t + 10}\right)$$

where T is the temperature (in degrees Fahrenheit) and t is the time (in hours).

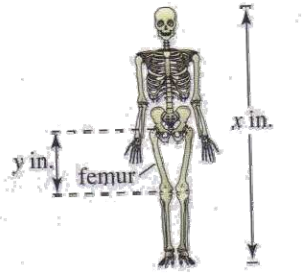
(a) Complete the table.

t (hrs)	0	3	6	9	12	15	18	21	24
T (°F)									

(b) What value of T does the mathematical model appear to be approaching?

Precalculus P.5 – Calculator Name _____

1. *Anthropology.* The relationship between the length of an adult's thigh bone and the height of the adult can be approximated by the linear equations
   $y = .432x - 10.44$ Female
   $y = .449x - 12.15$ Male
   where y is the length of the femur (thigh bone) in inches and x is the height in inches.



   (a) An anthropologist discovers a thigh bone belonging to an adult human female. The bone is 16 inches long. Estimate the height of the female.

   (b) From the foot bones of an adult male, an anthropologist estimates that the person's height was 69 inches. A few feet away from the site where the foot bones were discovered, the anthropologist discovered a male adult thigh bone that was 19 inches long. Is it likely that both the foot bones and thigh bone came from the same person?

2. *Airline Passengers*. An airline offers daily flights between Chicago and Denver. The total monthly cost of these flights is $C = \sqrt{.2x + 1}$ where C is the cost (in millions of dollars) and x is the number of passengers (in thousands). The total cost of the flights for a certain month is 2.5 million dollars. How many passengers flew that month?

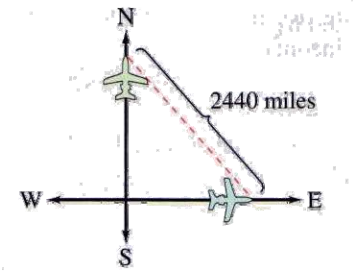
3. *Floor Space*. The floor of a one-story building is 14 feet longer than it is wide. The building has 1632 square feet of floor space.

   (a) Draw a diagram that gives a visual representation of the floor space. Represent the width as w and show the length in terms of w.

   (b) Write a quadratic equation for the area in terms of w in standard form.

   (c) Find the length and width of the building floor.

4. *Flying Speed*. Two planes leave simultaneously from the same airport, one flying due north and the other due east (see figure). The northbound plane is flying 50 miles per hour faster than the eastbound plane. After 3 hours the planes are 2440 miles apart. Find the speed of each plane.



5. *Economics*. The demand equation for a certain product is $p = 20 - .0002x$, where p is the price per unit and x is the number of units sold. The total revenue for selling x units is Revenue $= xp = x(20 - .0002x)$. How many units must be sold to produce revenue of \$500,000?

6. *Economics*. The demand equation for a certain product is modeled by $p = 40 - \sqrt{.01x + 1}$ where x is the number of units demanded per day and p is the price per unit. Approximate the demand if the price is \$37.55.

7. *Saturated Steam*. The temperature T (in degrees Fahrenheit) of saturated steam increases as pressure increases. This relationship is approximated by $T = 75.82 - 2.11x + 43.51\sqrt{x}$, $5 \le x \le 40$ where x is the absolute pressure (in pounds per square inch). Approximate the pressure if the temperature of the steam is 240°F.

Precalculus P.6 – Calculator Name _____

1. *Weightlifting*. For 60 men enrolled in a weightlifting class, the relationship between body weight x (in pounds) and maximum bench-press weight y (in pounds) can be modeled by the equation $y = 1.266x - 35.766$. Use this model to estimate the range of body weights of the men in this group that can bench press more than 200 pounds.

2. *Geometry*. A rectangular parking lot with a perimeter of 100 feet is to have an area of at least 500 square feet. Within what bounds must the length of the rectangle lie?

3. *Copying Costs*. Your department sends its copying to the photocopy center of your company. The center bills your department $0.10 per page. You have investigated the possibility of buying a departmental copier for $3000. With your own copier, the cost per page would be $0.03. The expected life of the copier is 4 years. How many copies must you make in the 4-year period to justify buying the copier?

4. *Safe Load*. The maximum safe load uniformly distributed over a 1-foot section of a 2-inch-wide wooden beam is approximated by the model Load = $168.5d^2 - 472.1$ where d is the depth of the beam in inches.

   (a) Evaluate the model for the values of d in the table.

d (in)	3	4	5	6	7	8
Load (lbs)						

   (b) Determine the minimum depth of the beam that will safely support a load of 2000 pounds.

5. *Economics*. The revenue and cost equations for a product are $R = x(50 - .0002x)$ and $C = 12x + 150{,}000$ where R and C are measured in dollars and x represents the number of units sold. How many units must be sold to obtain a profit of at least $1,650,000?