PRECALC Function Apps Name: Key

ANALYZING FUNCTIONS AS APPLICATIONS

Use your calculator to answer the following questions. Write all answers in complete sentences. If asked for approximations, round answers to the nearest tenth.

1) Ibuprofen is a medication used to relieve pain. The polynomial function

$$M(t) = .5t^4 + 3.45t^3 - 96.65t^2 + 347.7t \quad \text{where } 0 \le t \le 6$$

can be used to estimate the number of milligrams of ibuprofen in the bloodstream t hours after 400 mg of the medication has been swallowed.

a) Define the variables in the function. Identify which variable is dependent and which is independent. Explain.

let t = time in hours after 400mg taken (independent)

let M(t) = amount of ibuprofen in bloodstream t hours after it's taken

b) Graph the function over the given domain.

Hours

most amount of med in blood (could be 400)

Xmin: 0 Xmax: 6 Xscl: 1

Ymin: 0 Ymax: 500 Yscl: 1

least amount of med in blood

c) Estimate the amount of ibuprofen that will be in the bloodstream one hour after 400 mg has been swallowed.

1 hour → sub in 1 for t into eq.

OR, Graph on g.c. Then use CALC VALUE, x = 1

255 mg

d) Find when the maximum amount of ibuprofen will be in your bloodstream.

Calc max. 2.15 hours after injested → 2 hours, 9 min.

e) Write where the function is increasing and decreasing (in interval notation)

Increasing: (0, 2.15)

Decreasing: (2.15, 6)

2) During a 24-hour period, the temperature T (in degrees Fahrenheit) of a certain city can be approximated by the model

$$T(x) = 0.026x^3 - 1.03x^2 + 10.2x + 34 \qquad \text{where } 0 \le x \le 24$$

where x represents the time of day, with x=0 corresponding to 6 a.m.

a) Define the variables in the function. Identify which is dependent and which is independent. Explain.

x = # hours after 6 a.m (independent)

y : Temperature in deg. far.

b) Graph the function over the given domain.

Xmin: 0 Xmax: 24 Xscl: 1

Ymin: 0 Ymax: Yscl:

↑

Temperature ∴ 100° ?

c) What is the approximate temperature at 11 a.m.? at 6 p.m.? at midnight?

64° 11 a.m → x = 5 → sub in 5 or calc value x = 5

53° 6 p.m → x = 12 →

35.5 midnight → x = 18

d) At what time does the maximum temperature occur? What is the maximum temperature?

6.6 hours after 6 am → 12:36 pm

e) At what time does the minimum temperature occur? What is the minimum temperature?

19.8 hours after 6 am → 1:48 a.m.

-6 / 13.8

f) Write where the function is increasing and decreasing (in interval notation)

Increasing: [0, 6.6) ∪ (19.8, 24]

Decreasing: (6.6, 19.8)

Key

PRECALC FUNCTION APPLICATIONS REVIEW Date: ______

I. Linear forms: $y = mx + b$

$Ax + By = C$

A. Michaela's mom is trying to decide between two plumber companies to fix her sink. The first company charges \$50 for a service call, plus an additional \$36 per hour for labor. The second company charges \$35 for a service call, plus an additional \$39 per hour of labor. At how many hours will the two companies charge the same amount of money?

Let x = # hours labor

y = Total cost

$y_1 = 36x + 50$

$y_2 = 35 + 39x$

CALC Intersect

or set =

So, $36x + 50 = 39x + 35$

$15 = 3x$

$x = 5$ hours.

B. A store sells two different types of coffee beans; the more expensive one sells for \$8 per pound, and the cheaper one sells for \$4 per pound. The beans are mixed to provide a mixture of 50 pounds that sells for \$6.40 per pound. How much of each type of coffee bean should be used to create 50 pounds of the mixture?

Let x = # pounds \$8 coffee — 30 pounds

y = # pounds \$4 coffee — 20 pounds

Quantity: pounds $x + y = 50$

Value: (\$) $8x + 4y = 6.40(50)$

$\to -4x - 4y = -200$

$8x + 4y = 320$

$4x = 120$

$x = 30$

II. Quadratic forms:

$y = ax^2 + bx + c$

Let x = # price changes

A. A popular designer purse sells for $500 and 45,000 are sold a month. The company did some research and realized that for each **$20 decrease in price**, they can sell **5000 more purses** per month. How much should the company charge for the purse so they can **maximize monthly revenues?**

p ·	q =	R
500	45,000 =	
480	50,000	
⋮		
$(500-20x)$	$(45{,}000 + 5000x)$	

$y_1 =$

calc max

$x = 8$

so price $= 500 - 20(8)$

$= \$340$

B. AHS is going to send a team to the Annual Pumpkin' Chukin' contest in New Hampshire this fall. So far, in testing, their device has launched the pumpkin from a height of 8 feet off the ground with an initial velocity of 24 feet per second. $h(t) = -16t^2 + V_0 t + h_0$

a). Create an equation that represents the height of the pumpkin, h(t), t seconds after launch.

$V_0 = 24$ $\quad h(t) = -16t^2 + 24t + 8$

$h_0 = 8$

b). Using this model, what would the max distance be that their pumpkin would travel? (how long until it hits the GROUND)

Ground → height of 0 → calc zero $\quad$ 1.78 sec

$0 = -16t^2 + 24t + 8$ → solve by factoring or QF

c). What is the max ~~height the pumpkin~~ would reach?

$\boxed{\text{17 feet calc max}}$

window

xmin = 0

xmax = 5

ymin = -5

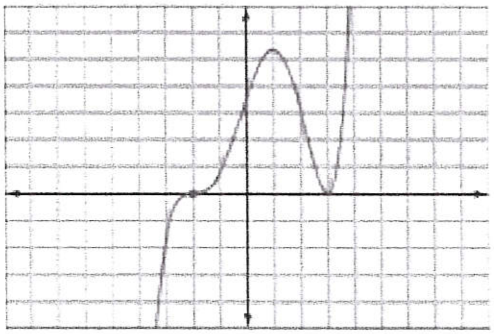
ymax = 40

$0 = -8(2t^2 - 3t - 1)$

$0 = (2t \quad)(t \quad)$

:(

III. Polynomial form:



A. An engineer designs a rollercoaster so that a section of the ride can be modelled by the function $h(x) = -0.000\,000\,4x(x - 15)(x - 25)(x - 45)^2(x - 60)$, where x ~~is the horizontal distance from the boarding platform~~ time in secs., ~~in metres~~; $x \in [0, 60]$; and h is the height, in metres, above or below the boarding platform.

. a) Sketch! degree 6

a neg.

roots:

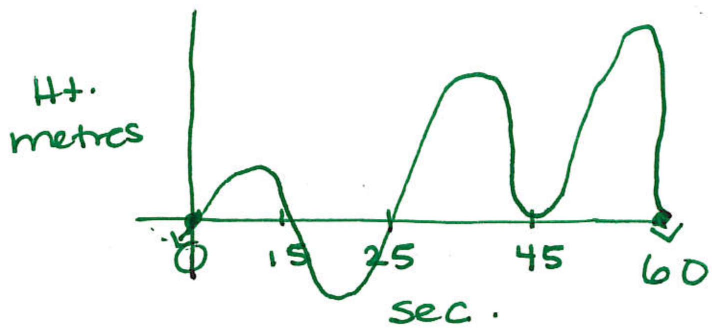
$x = 0$

$x = 15$ S.T

$x = 25$

$x = 45$ - bounce

$x = 60$ S.T.



Use your G.C. to

b. Estimate the maximum and the minimum height of the rollercoaster relative to the boarding platform.

Calc max: 35.3 ~~feet~~ metres (above)

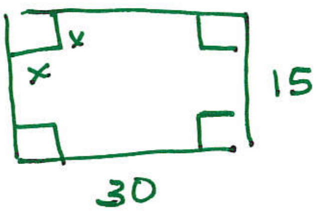
Calc min: -5.1 metres (below)

c. How long is this segment of the ride?

60 seconds.

B. Maximum Volume Problem:

A piece of cardboard **30 inches** by **15 inches** is made into an open donut box by cutting out squares of side *x* from each corner.



$$V = (30 - 2x)(15 - 2x)\,x$$

Cal.

(a) Write a polynomial P(x) that represents the volume of this open box in factored form, and then in standard form.

$$P(x) = x\,(30 - 2x)(15 - 2x)$$

$$= (30x - 2x^2)(15 - 2x)$$

$$= 450x - 60x^2 - 30x^2 + 4x^3$$

$$= 4x^3 - 90x^2 + 450x$$

(b) What would be a reasonable domain for the polynomial? (Hint: Each side of the three-dimensional box has to have a length of at least 0 inches).

$x_{min} = 0$

$x_{max} = 7.5$

D: $x \in (0, 7.5)$

(c) Find the value of *x* for which $V(x)$ P(x) has the greatest volume. Round to 2 decimal places.

Calc max. 3.17 in.

(d) What is that maximum volume? Round to 2 decimal places.

649.52 in^3

(e) What are the dimensions of the three-dimensional open donut box with that maximum volume? Round to 2 decimal places.

$h = 3.17$ in

$L = 30 - 2(3.17) = 30 - 6.34 = 23.66$ in.

$w = 15 - 2(3.17) = 15 - 6.34 = 8.66$ in