Name Key Date

Mrs. Roumbos 8A CC Algebra 1

Notes: The constant at the end of the equation is the y-intercept. The y-unit is where the object is being tossed from. If there is no constant that means 0 (ground)

Parabola Word Problems Classwork

1) Tom throws a ball into the air. The ball travels on a parabolic path represented by the equation $h = -8t^2 + 40t$, where h is the height, in feet, and t is the time, in seconds.

c=0 (starts at ground)

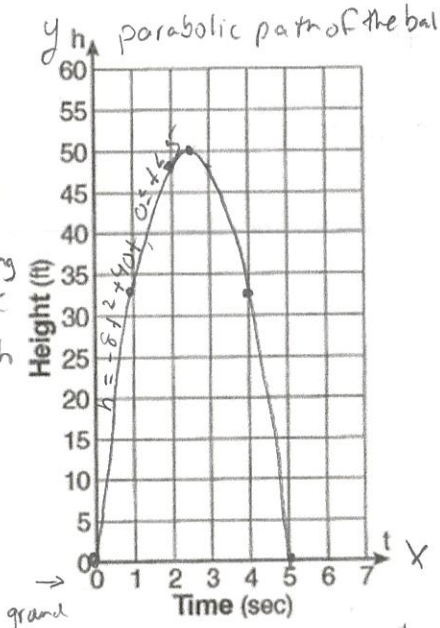
a) On the accompanying set of axes, graph the equation from $t = 0$ to $t = 5$ seconds, including all integral values of t from 0 to 5.

→ constraint/interval

$0 \le t \le 5$

t	h
0	0 ← ground
1	32
2	48
2.5	50
3	48
4	32
5	0 ← ground

★ must have turning point in table and must graph turning point



how to get T.P.

Calc
x = t
y = h

a = -8 b = 40 c = 0

$x = \frac{-b}{2a}$

$x = \frac{-(40)}{2(-8)}$

$x = \frac{-40}{-16}$

$x = 2.5$

t = 2.5

$h = -8t^2 + 40t$

$h = -8(2.5)^2 + 40(2.5)$

$h = -8(6.25) + 40(2.5)$

$h = -50 + 100$

$h = 50$

(2.5, 50)
↓ ↓
t h

★ Zoom Fit to see the entire graph in the calculator

★ no arrows b/c constraints given

★ no arrows b/c no negative height or time → This is what you would have to say if it asked to explain in context ★

t: Time (x-value)

h: height (y-value)

b) What is the value of t at which h has its greatest value?

t = 2.5 seconds at a max height of 50ft

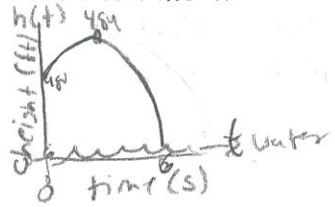
★ asking for the x-value of the vertex/T.P.

Calc way to get decimal turning point:

2nd window ΔTbl = .5

2) Jason jumped off a cliff into the ocean in Acapulco while vacationing with some friends. His height as a function of time could be modeled by the function $h(t) = -16t^2 + 16t + 480$, where t is the time in seconds and h is the height in feet.

C = 480 Started at a height of 480



t: time (x-value)

h(t): height (y-value)

a) How long did it take for Jason to reach his maximum height?

aka vertex

Vertex / V.P.

t	h(t)	
0	480	← Top of cliff
½	484	calc: 2nd window ΔTbl = .5
1	480	
2	448	
3	384	
4	288	
5	160	
6	0	← water

*Don't Copy any Neg. y-values (height can't be negative)

½ second

$a = -16 \quad b = 16 \quad c = 480$

$x = \frac{-b}{2a}$

$x = \frac{-(16)}{2(-16)}$

$x = \frac{-16}{-32}$

$x = \frac{1}{2}$

Key

x = t

y = h(t)

b) What was the highest point that Jason reached?

h(t): height (y-value)

$t = \frac{1}{2}$

$h(t) = -16t^2 + 16t + 480$

$h(\frac{1}{2}) = -16(\frac{1}{2})^2 + 16(\frac{1}{2}) + 480$

$h(\frac{1}{2}) = -16(\frac{1}{4}) + 16(\frac{1}{2}) + 480$

$h(\frac{1}{2}) = -4 + 8 + 480$

$h(\frac{1}{2}) = 484$

484 ft

↳ y-value of the T.P.

$(\frac{1}{2}, 484)$

↓ ↓

t h(t)

* If graphing on calc press Zoom fit to see the graph

t: time (x-value)

c) Jason hit the water after how many seconds?

when the height is 0 (y=0 / h(t)=0)

6 seconds

$h(t) = -16t^2 + 16t + 480$

plug 0 in for h(t) → $0 = -16t^2 + 16t + 480$

$+16t^2 - 16t - 480 \quad +16t^2 - 16t + 480$

$16t^2 - 16t - 480 = 0$

$16(t^2 - t - 30) = 0$

$16(t-6)(t+5) = 0$

$16 \neq 0 \quad | \quad t-6=0 \quad | \quad t+5=0$

$+6 \quad +6 \qquad -5 \quad -5$

$t = 6 \qquad t = -5$ reject, N Negative time

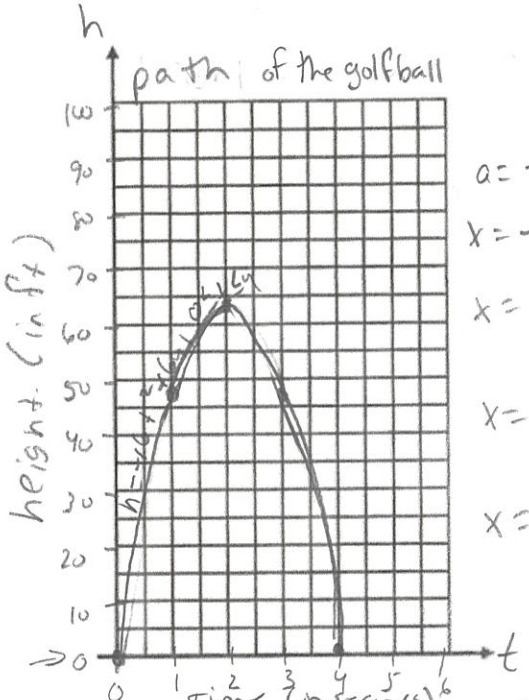
This is the work you would show if it said: show work algebraically. Otherwise you can just get the answer from the table

3) The height in feet of a golf ball hit into the air is given by $h = -16t^2 + 64t$, where t is the number of seconds elapsed since the ball was hit.

c = 0 starts at the ground

a) Graph h on the accompanying graph from $0 \le t \le 4$ (constraint/interval)

t	h
0	0 ← ground
1	48
2	64
3	48
4	0 ← ground



Key
x = t
y = h

$a = -16 \quad b = 64 \quad c = 0$

$x = \frac{-b}{2a}$

$x = \frac{-(64)}{2(-16)}$

$x = \frac{-64}{-32}$

$x = 2$

$t = 2$

$h = -16t^2 + 64t$

$h = -16(2)^2 + 64(2)$

$h = -16(4) + 64(2)$

$h = -64 + 128$

$h = 64$

(2, 64)
t h

h: height (y-value) ✱ NO arrows b/c NO neg height/time + b/c constraints given
↳ this is the explanation you must give when it says: in context

b) What is the maximum height of the ball?

64 ft (y-value of the T.P.)

vertex / T.P.

t: time (x-value)

c) How long does it take for the ball to reach its maximum height?

2 seconds (x-value of the T.P.)

t: time (x-value)

d) How long does it take for the ball to hit the ground?

4 seconds

(where h = 0 / y = 0)

h: height (y-value)

✱ plug 0 in for h

$0 = -16t^2 + 64t$

$+16t^2 - 64t \quad +16t^2 - 64t$

$16t^2 - 64t = 0$

$16t(t-4) = 0$

$16t = 0 \quad | \quad t - 4 = 0$

$\frac{16t}{16} = \frac{0}{16} \quad | \quad +4 \quad +4$

$t = 0 \quad | \quad t = 4$

start on ground | end on ground

work if they asked you to show your work algebraically

t: time (x-value)

e) For how many seconds is the ball more than 48 feet up in the air?

$1 < t < 3$

1.1 → 2.9 = 1.8

= 2 seconds

t: time (x-value)

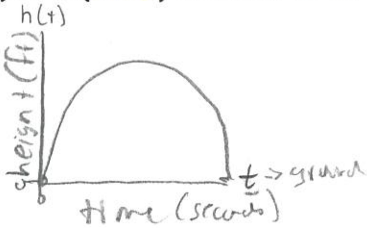
f) Determine all values of t for which $h > 48$

$1 < t < 3$

4) A model rocket is launched. The height, in feet, of the rocket h(t) at t ($t \geq 0$) seconds after the launch is determined by the equation $h = -\frac{1}{2}t^2 + 15t$

No neg. time

c=0 starts at the ground



key
x=t
y=h(t)

a) Find the maximum height of the rocket.

h : height (y-value)

don't copy any neg #'s

vertex/T.P.

t	h(t)	t	h(t)	t	h(t)
0	0 ← ground	11	104.5	21	94.5
1	14.5	12	108	22	88
2	28	13	110.5	23	80.5
3	40.5	14	112	24	72
4	52	15	112.5	25	62.5
5	62.5	16	112	26	52
6	72	17	110.5	27	40.5
7	80.5	18	108	28	28
8	88	19	104.5	29	14.5
9	94.5	20	100	30	0 ground
10	100				

t : time (x-value)

112.5 ft (y-value of the T.P.)

a = $-\frac{1}{2}$ b = 15 c = 0

$x = -\frac{b}{2a}$

$x = \frac{-(15)}{2(-\frac{1}{2})}$

$x = \frac{-15}{-1}$

x = 15

t = 15

$h = -\frac{1}{2}t^2 + 15t$

$h = -\frac{1}{2}(15)^2 + 15(15)$

$h = -\frac{1}{2}(225) + 15(15)$

h = −112.5 + 225

h = 112.5

(15, 112.5)
t, h

h : height y-value

b) Find the number of seconds after the launch it takes for the rocket to reach its *maximum* height.

aka vertex

15 seconds (x-value of the T.P.)

t: time (x-value) h(t): height y-value

c) For how many seconds will the rocket be at the height or more then 100ft?

10 < t < 20

10.1 → 19.9 = 9.8

10 seconds