Name: Answer Key

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SUPPORT 2.2

The quadratic model

1 Observe the following graphs closely; they represent quadratic functions.

a) Determine the coordinates of the vertex of each parabola.

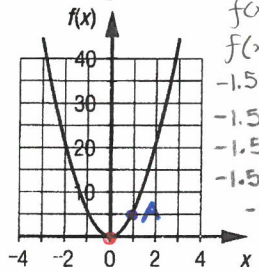
b) Determine the coordinates of point A whose *x*-coordinate is one unit greater than the *x*-coordinate of the vertex.

c) Estimate the value of parameter **a** of the quadratic function by calculating the difference between the value of the *y*-coordinate of point A and the vertex.

d) Using your answers to the preceding questions, determine the rule for each of these functions.

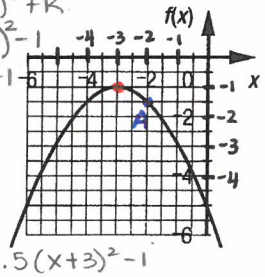
Vertex (0,0)
h=0 k=0
$f(x)=a(x-h)^2+k$
$f(x)=a(x-0)^2+0$
$f(x)=ax^2$
$5=a(1)^2$
$5=1a$
$f(x)=5x^2$

Graph 1



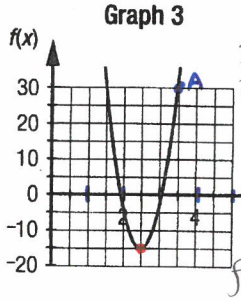
Vertex (-3,-1)
h=-3 k=-1
$f(x)=a(x-h)^2+k$
$f(x)=a(x+3)^2-1$
$-1.5=a(-2+3)^2-1$
$-1.5=a(1)^2-1$
$-1.5=1a-1$
$-1.5+1=1a$
$-0.5=a$
$f(x)=-0.5(x+3)^2-1$

Graph 2



Vertex (2.5, -15)
h=2.5 k=-15
$f(x)=a(x-h)^2+k$
$f(x)=a(x-2.5)^2-15$
$30=a(3.5-2.5)^2-15$
$30=a(1)^2-15$
$30+15=a$
$45=a$
$f(x)=45(x-2.5)^2-15$

Graph 3



a) Vertex (0, 0) **b)** Point A (1, 5) **c)** Parameter **a** = 5 **d)** Rule: $f(x)=5x^2$

a) Vertex (-3, -1) **b)** Point A (-2, -1.5) **c)** Parameter **a** = -0.5 **d)** Rule: $f(x)=-0.5(x+3)^2-1$

a) Vertex (2.5, -15) **b)** Point A (3.5, 30) **c)** Parameter **a** = 45 **d)** Rule: $f(x)=45(x-2.5)^2-15$

2 Consider the table of values below.

x	0	1	2	3	4	5	6	7	8
x^2	0	1	4	9	16	25	36	49	64
y	0	-2.5	-10	-22.5	-40	-62.5	-90	-122.5	-160

(4,-10) (16,-40)

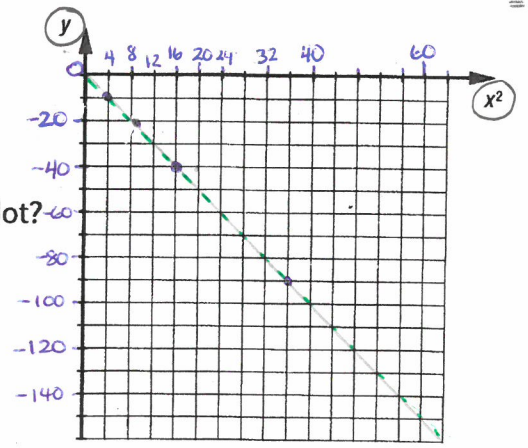
$a=\frac{y_2-y_1}{x_2-x_1}=\frac{(-40)-(-10)}{(16)-(4)}$

$=\frac{-30}{12}$

$=\frac{-5}{2}$ OR -2.5

a) Complete the table of values.

b) Draw a scatter plot with the values of x^2 as the *x*-coordinates and the values of *y* as the *y*-coordinates.



c) Which model best represents this scatter plot?

Decreasing Linear model

d) Determine the equation of this function.

$y=-2.5x^2$

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3 Associate each of the equations below with the corresponding curve on the graph.

$f(x) = 3(x - 4)^2 + 2$ Curve 3

$f(x) = -3(x + 4)^2 - 2$ Curve 5

$f(x) = 0.5(x + 4)^2 + 2$ Curve 2

$f(x) = -0.5(x - 4)^2 - 2$ Curve 7

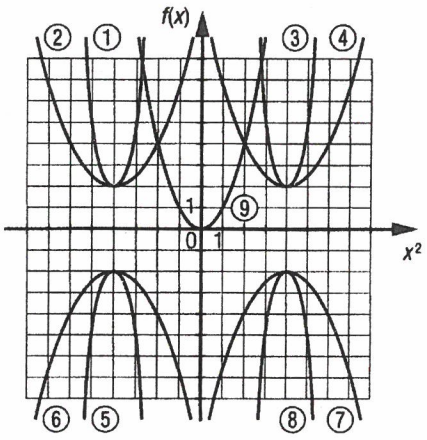
$f(x) = -3(x - 4)^2 - 2$ Curve 8

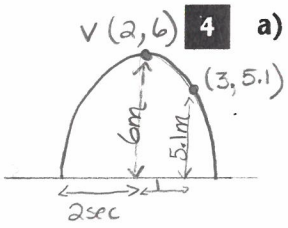
$f(x) = x^2$ Curve 9

$f(x) = 3(x + 4)^2 + 2$ Curve 1

$f(x) = -0.5(x + 4)^2 - 2$ Curve 6

$f(x) = 0.5(x - 4)^2 + 2$ Curve 4





4 **a)** Tom throws a ball that attains its maximum height of 6 m, 2 s after it is thrown. One second later, the ball reaches a height of 5.1 m. Since the height as a function of time can be modelled by a quadratic function, determine the coordinates of the vertex of the parabola for this function. What are the values of the parameters **h** and **k**?

Vertex (2, 6)

b) Determine the value of parameter **a** using the same method as in number **1.**

$f(x) = a(x-2)^2 + 6$

$5.1 = a(3.2)^2 + 6$

$5.1 - 6 = a(1)^2$

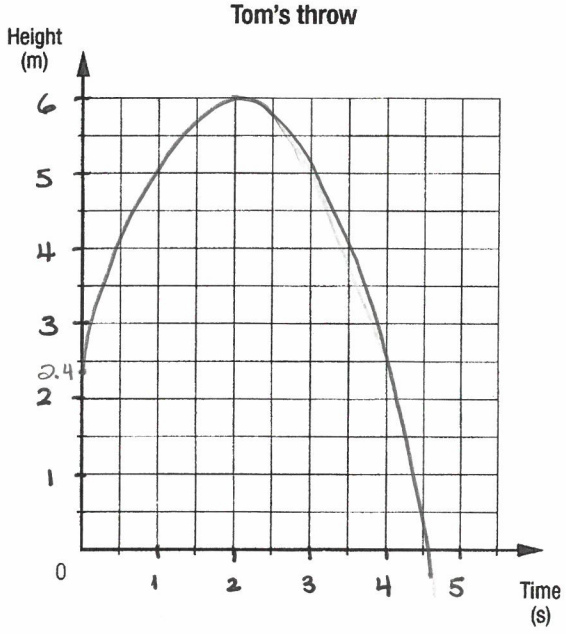
$-0.9 = 1a$

$a = -0.9$

c) What is the equation of this function?

$f(x) = -0.9(x-2)^2 + 6$

d) Represent this function in the adjacent Cartesian plane.



e) What was the initial height of the ball when Tom threw it?

$f(x) = -0.9(x-2)^2 + 6$

$f(0) = -0.9(0-2)^2 + 6$

$= -0.9(-2)^2 + 6$

$= -0.9(4) + 6$

$= -3.6 + 6$

$= 2.4$

The ball was at a height of 2.4m

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