Exemplar

STATION A

LT 2.1 I can create an equation that models a scenario and explain my work. (A-CED.2)

(C) Know the different types of growth that can model a scenario (C) Knows how the parts of an equation relate in context. (P) Create equations, inequalities, or systems to model scenario (P) Explain the reasoning and steps of creating an equation

a) What is the general equation of a quadratic in vertex form, standard form, and factored form?

Vertex: $y=a(x-h)^2+k$

Standard: $y=ax^2+bx+c$

Factored: $y=a(x-m)(x-n)$

b) Write the equation of a quadratic that has a vertex of (-1,3) and contains the point (4,-1).

(h, k) (x, y)

$y=a(x--1)^2+3$

$y=a(x+1)^2+3$

$-1=a(4+1)^2+3$

$-1=a(5)^2+3$

$-3 \quad -3$

$\frac{-4}{25}=\frac{a(25)}{25}$

$a=-.16$

$\boxed{y=-.16(x+1)^2+3}$

c) Write the equation of the quadratic in the graph in vertex form.

$y=a(x-1)^2+4$

$-1=a(3-1)^2+4$

$-1=a(2)^2+4$

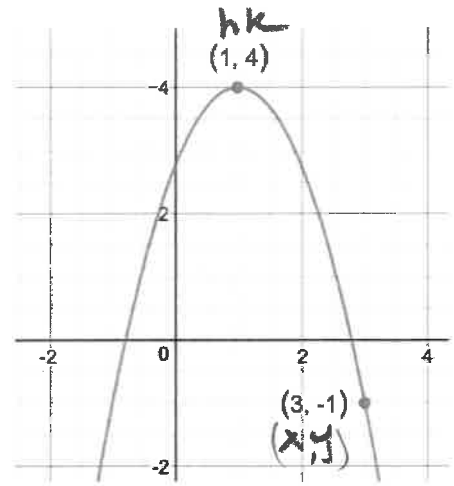
$-1=a(4)+4$

$-4 \quad -4$

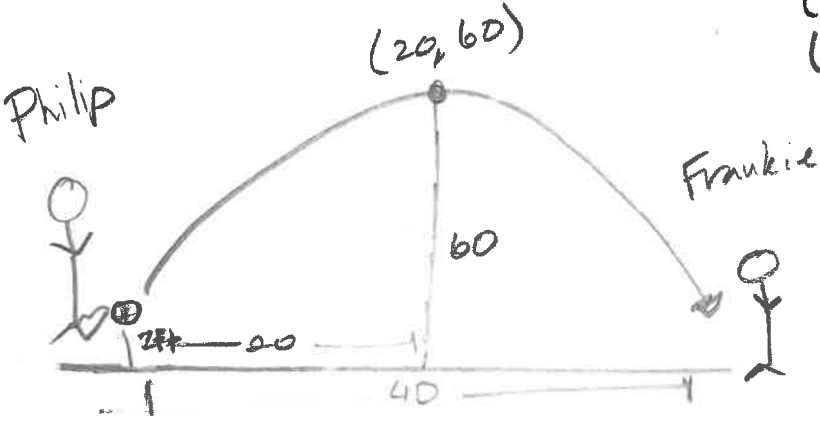
$\frac{-5}{4}=\frac{a(4)}{4}$

$-1.25=a$

$\boxed{y=-1.25(x-1)^2+4}$



d) Philip kicks a bouncing ball, at a height of 2 feet, into the air to his friend Frankie who is standing 40 feet away from him. The ball reached a maximum height of 60 feet into the air when it was exactly the midpoint between Philip and Frankie. Create the equation that represents the path of the ball after it was kicked.



(0, 2) x y

(20, 60) h k

$y=a(x-20)^2+60$

$2=a(0-20)^2+60$

$-60 \quad -60$

$-58=a(-20)^2$

$\frac{-58}{400}=\frac{a(400)}{400}$

$\boxed{-.145=a}$

$\boxed{y=-.145(x-20)^2+60}$

Exemplar

STATION B

LT 2.2 I can make sense and explain of various parts of an equation within a context (A-SSE.A1.b)
(C) Know how to interpret parts of an equation (within or out a context)
(P) Explain in their own words what the parts of the equation represent in context.

1) A unique bacteria population can be represented by the equation $P(t)=12{,}005(.894)^t$. where t represents the number of years after 2002 and P(t) represents the bacteria population.

A) What is the bacteria population in the year 2005? (3 years Later) $P(3) = 12{,}005(.894)^3$

In 2005 there will be 8,577 bacteria in the populatio

B) Is the population growing or decaying? Explain?

The Population is decaying because the growth Factor .894 is less than 1 Meaning it has a common multiplier of less than 1

C) By what percentage is the bacteria population increasing/decreasing by? $1.00 - .0894 = .106 \Rightarrow 10.6\%$

The bacteria population is decaying by 10.6% each year

LT 2.3 I can build a function that models a scenario and solve for specific quantities. (F-BF.1)

(C) Know how to work with function notation (C) Know independent vs Dependent variables (P) Create a function of various growth rates

1) a) The town of Pico Rivera has a population, P, of 62,000 in 2009. The population grew by 2% each year. Create an equation that represents the population P(t) where t is time in years.

$P(t) = 62{,}000(1+.02)^t \Rightarrow \boxed{P(t) = 62{,}000(1.02)^t}$

b) What was the population in 2015? — 6 years later

$P(6) = 62{,}000(1.02)^6$

$P(6) = 69{,}822$

The town will have about 69,822 people.

c) In how many years will the population reach a total of 80,000 people?

$\frac{80{,}000}{62{,}000} = \frac{62{,}000(1.02)^t}{62{,}000} \Rightarrow 1.29 = (1.02)^t$

$\log_{1.02}(1.29) = t$

$\boxed{t = 12.87}$

It'll take 12.87 years to reach 80,000 people.

2) How long will a savings account take to reach $5,000 if the initial investment was $2,000 and there is an increase of 3.3% each year?

goal I.V.

$3.3 \to .033$

$A(t) = 2000(1+.033)^t$

$\frac{5000}{2000} = \frac{2000(1.033)^t}{2000}$

$2.5 = (1.033)^t$

$\log_{1.033}(2.5) = t$

$\boxed{28.22 = t}$

It will take the Account 28.22 years to reach $5,000

Exemplar

STATION C

LT 2.4 I can explain the effect to a graph given a specific function notation. (F-BF.3)

(C) Know the effect of k-value to the graph if f(x) + k, kf(x), f(kx), f(x+k). (C) Recognize even and odd symmetry in graphs.
(P) Explain the effect of a graph given function notation. (P) Apply transformations to a function.

1) Which function g(x) represents the function $f(x)=(x+2)^2+1$ after a vertical shift 4 units up, a horizontal shift 2 units to the left, and a vertical reflection.

neg a. ← +2 ↑ +4

A) $g(x)=(x+4)^2+5$

B) $g(x)=-(x+4)^2+5$

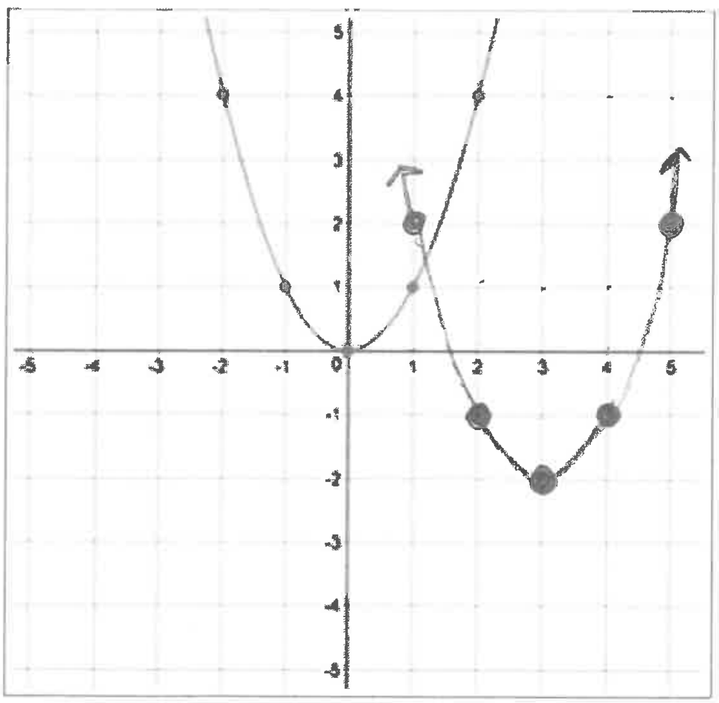
C) $g(x)=(x)^2+5$

D) $g(x)=(x-2)^2+5$

2) The graph of the parent function for a quadratic $f(x)=x^2$ is given below.
On the same coordinate plane, graph the function of g(x) if:

a) $g(x)= f(x-3) - 2$.

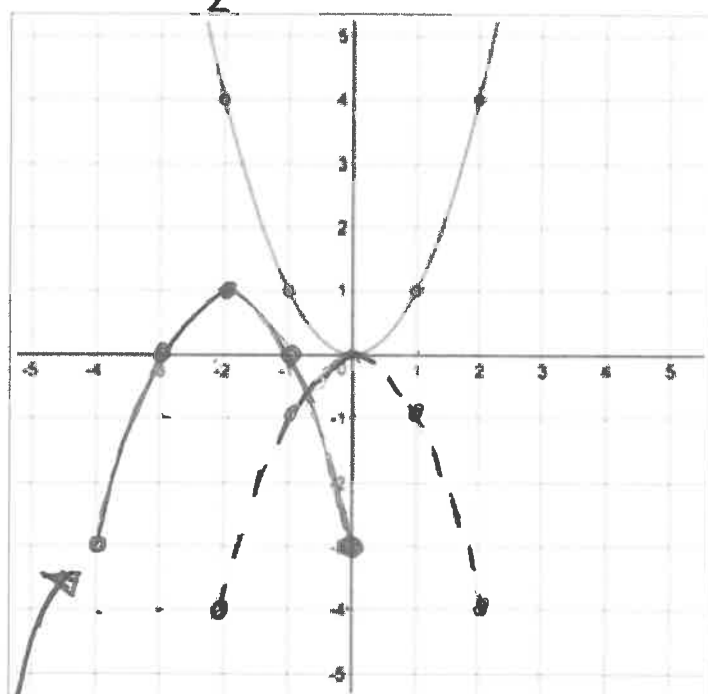
3 → ↓2



b) $g(x)= -f(x+2) + 1$.

Reflect

← 2 ↑ 1



Final Answer

Exemplar.

STATION D

LT 2.5 I can solve for the key features of a graph and relate them to a context. (A-REI.4)
(C) Understand key features of a function through graphs and tables. (C) Use different representations of functions (graphs, tables, and symbols) (P) Interpret key features of graphs and tables of a function (extreme values, end behavior, and intervals of increase/decrease). (P) Create and explain a graph that models a certain context and vice versa.

1) Find the roots of the following quadratic:

a) $y = 2x^2 + 2x - 9$

$\boxed{2x}$ $\boxed{-3}$ $\boxed{x}$ $\boxed{3}$

$-3x$
$6x$
$3x$ ✗

Not Factorable!

$$x = \frac{-2 \pm \sqrt{(2)^2 - 4(2)(-9)}}{2(2)}$$

$$\frac{-2 \pm \sqrt{76}}{4} = \frac{-2 \pm 8.72}{4}$$

$x = \boxed{(1.68, 0); (-2.68, 0)}$

b) $f(x) = -x^2 + 4x + 12$

$\boxed{-x}$ $\boxed{6}$ $\boxed{1x}$ $\boxed{2}$

$6x$
$-2x$
$4x$ ✓

$-x + 6 = 0$
$-6 \quad -6$
$\frac{-x}{-1} = \frac{-6}{-1}$
$\boxed{x = 6}$

$x + 2 = 0$
$-2 \quad -2$
$\boxed{x = -2}$

$\boxed{(6,0); (-2,0)}$

2) Use the Quadratic formula to find the roots of the following:

$f(x) = 6x^2 - 7x - 3$

$$\frac{-(-7) \pm \sqrt{(-7)^2 - 4(6)(-3)}}{2(6)} = \frac{7 \pm \sqrt{49 + 72}}{12}$$

$$\frac{7 \pm \sqrt{121}}{12} = \frac{7 \pm 11}{12}$$

$$\frac{7 + 11}{12} = 1.5$$

$$\frac{7 - 11}{12} = -.3\bar{3}$$

$\boxed{\text{Roots!}}$
$(1.5, 0)$
$\&$
$(-.3\bar{3}, 0)$

3) Determine which quadratic equation has 0,1, or 2 roots.

a) $f(x) = 10x^2 + 4x + 2$

Discriminant
$D = B^2 - 4aC$

$4^2 - 4(10)(2)$
$16 - 80$
-64
$\boxed{\text{No Real Roots}}$

b) $f(x) = 2x^2 + 5x - 1$

$(5)^2 - 4(2)(-1)$
$25 + 8$
33
$\boxed{\text{2 Real Roots}}$

c) $f(x) = x^2 - 4x + 4$

$(-4)^2 - 4(1)(4)$
$16 - 16$
0
$\boxed{\text{1 Real Root}}$

4) Find the Complex roots of the following quadratics

a) $f(x) = 2x^2 + 2x + 5$

$$x = \frac{-2 \pm \sqrt{2^2 - 4(2)(5)}}{2(2)} = \frac{-2 \pm \sqrt{4 - 40}}{4}$$

$$\frac{-2 \pm \sqrt{-36}}{4} = \frac{-2 \pm 6i}{4} \div 2$$

$\sqrt{-36}$
$\sqrt{36} \; \sqrt{-1}$

$$\boxed{x = \frac{-1 \pm 3i}{2}}$$

b) $f(x) = 2x^2 + 8x + 10$

$$x = \frac{-8 \pm \sqrt{8^2 - 4(2)(10)}}{2(2)} = \frac{-8 \pm \sqrt{64 - 80}}{4}$$

$$\frac{-8 \pm \sqrt{-16}}{4} = \frac{-8 \pm 4i}{4} \div 4$$

$\sqrt{-16}$
$\sqrt{16} \; \sqrt{-1}$

$\boxed{x = -2 \pm i}$

STATION E

LT 2.7 I can calculate the average rate of change from many representations (Table, Graph, and Symbols) and explain what it means. (F-IF.6)
(C) Interpret the average rate of change (P) Calculate the average rate of change (P) Explain what the average rate of change represents

a) What is the average rate of change for the function $f(x) = 2x^2 + 1$ on the interval $0 \le x \le 2$

a b

(0, 1)
a f(a)

$f(0) = 2(0)^2 + 1$
$f(0) = 1$

(2, 9)
b f(b)

$f(2) = 2(2)^2 + 1$
$8 + 1$
$f(2) = 9$

AROC: $\frac{9-1}{2-0} = \frac{8}{2} = 4$

$\boxed{\text{AROC: } 4}$

b) An object is falling from the sky, its height above the ground changes according to $h(t) = -2t^2 + 10$, where t is time in seconds and h is height in meters.

What value for t correctly completes the statement below?

Between t= 1 and t= __4__, the height of the object decreases at an average rate of 10 meters per second.

(1, 8)
a f(a)

$h(1) = -2(1)^2 + 10$
$-2 + 10$
$h(1) = 8$

(4, -22)
b f(b)

$h(4) = -2(4)^2 + 10$
$h(4) = -22$

$\frac{f(b) - 8}{b - 1} = -10$

$\frac{-22-8}{4-1} \stackrel{?}{=} -10$

$-\frac{30}{3} \stackrel{?}{=} -10$

$-10 = -10$ ✓

$\boxed{t = 4}$

LT 2.8 I can match the graph of an exponential functions with its corresponding equation. (F-IF.7e)
(C) Know Exponential, logarithmic, and trigonometric functions. (C) Know Key features/components of exponential functions (C) Know the connection between exponential and logarithmic functions (P) Describe components of exponential functions (domain, range, y-intercept, end behavior) (P) Sketch graphs of exponential and logarithmic functions and state the connection.

2) Consider the exponential functions below. Which equations represent growth, decay, or neither? Rewrite the equation in the box.

$f(x) = 2\left(\frac{1}{2}\right)^x$ $f(x) = 0.02(1)^x$ $f(x) = 1\left(\frac{1}{2}\right)^{-x}$ $f(x) = 6(1.56)^x$

Growth	Decay	Neither
$f(x) = 1\left(\frac{2}{1}\right)^x$ $f(x) = 6(1.56)^x$	$f(x) = 2\left(\frac{1}{2}\right)^x$	$f(x) = 0.02(1)^x$

LT 2.6 I can determine the domain and range of a graph given the context. (F-IF.5)
(C) Connect domain and range to a context Continuous vs. Discrete (P) Determine domain and range given a context (P)Connect a function to a context using its quantities.

When a ball bounced, its height above the ground was described by the function h(t)= $-4t^2 + 8t$, where t = time in seconds and h(t) = height in feet.

x-values

What is the domain of this function in this situation?

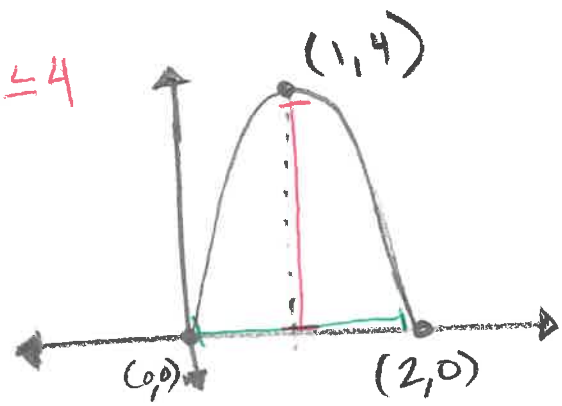
Set: [0, 2]

Interval: $0 \le t \le 2$.

What is the range of this function in this situation?

Set: [0, 4]

Interval: $0 \le h(t) \le 4$



$\boxed{\text{Vertex}}$

$t = \frac{-b}{2a} = \frac{-8}{2(-4)} = \frac{-8}{-8} = 1$

$t = 1$

$h(1) = -4(1)^2 + 8(1)$

$-4 + 8$

$h(1) = 4$

$(1, 4)$

$\boxed{\text{Roots}}$

$0 = -4t^2 + 8t$

$0 = -4t(t-2)$

$0 = -4t$ $\quad$ $0 = t - 2$

$\boxed{0 = t}$ $\quad$ $+2 \quad +2$

$\boxed{2 = t}$