Homework

1) Find the vertex

$y=-(x+0)^2-1$

a=−1
h=0
k=−1

The parabola opens down because "a" is negative.
Vertex (h,k) = (0,-1)

X	Y
-1	$(-(-1)^2-1) = -2$
0	-1
1	$(-1^2-1) = -2$

ANSWER: D. $j(x) = -x^2-1$

2) Rewrite in vertex form

$a(x+d)^2 = e$

a = 2
b = -8
c = 3
d = b/2a = -8/(2*2) = -2
$e = c - b^2/4a = 3 - (-8^2)/(4*2) = -5$

$2(x-2)^2-5$
$y = 2(x-2)^2-5$

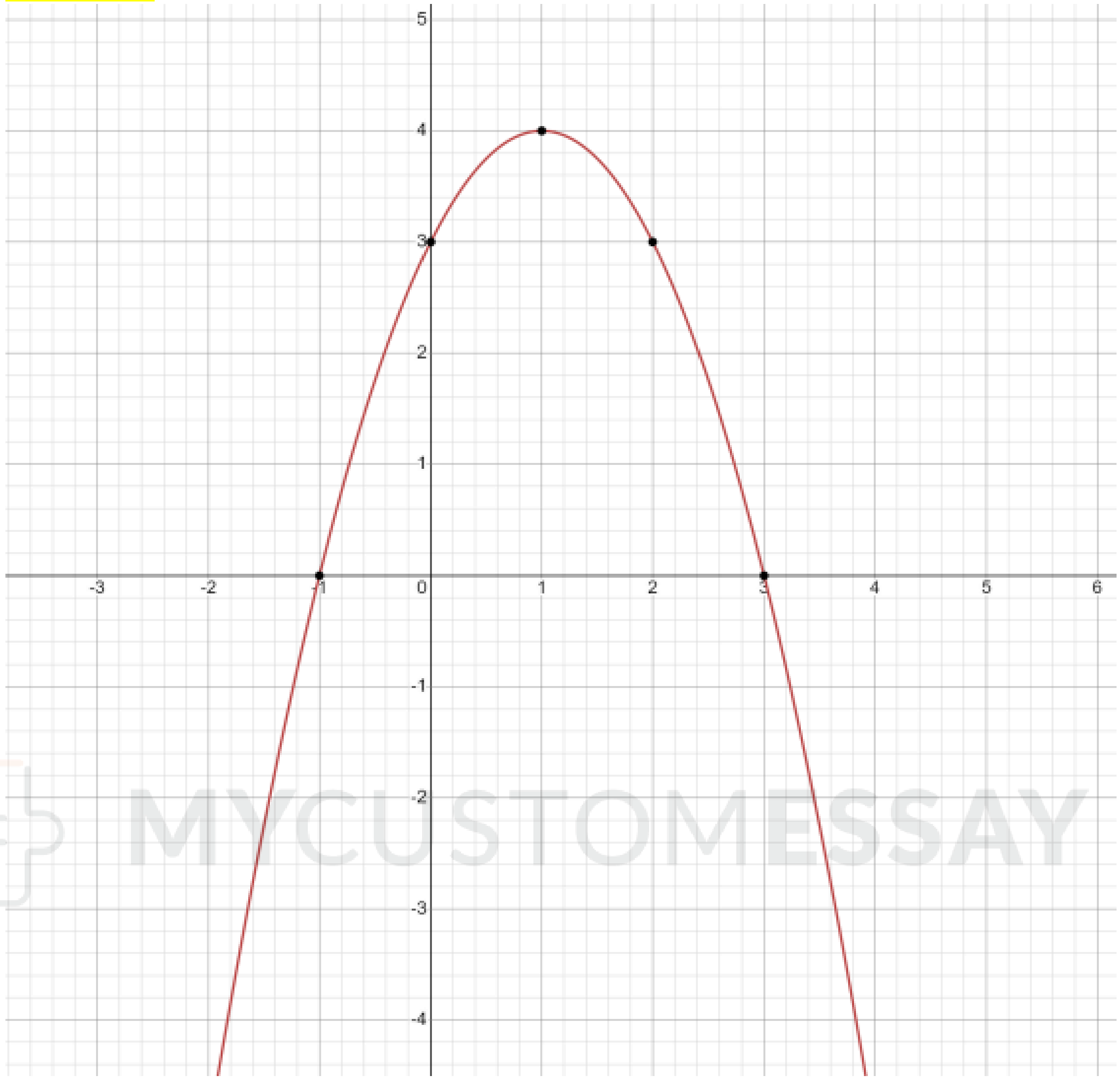
a = 2
h = 2
k = -5

Vertex (h,k) = (2,-5)

ANSWER: The vertex is at x = 2 and y = -5.

3)

a. **ANSWER:**



a = -1
h = 1
k = 4

Vertical (h,k) = (1,4)

X	Y
-1	**4 – (-1-1)2 = 0**
0	**4 – (0-1)2 = 3**
1	**4**
2	**4 – (0-2)2 = 3**

b. ANSWER: Axis of symmetry → x = 1
c. ANSWER: Domain → (−∞,∞) ; Range → (−∞, 4]

4) a. a = -0.8

b = 10.4

h = -b/2a = -10.4/(2*-0.8) = 6.5

ANSWER: k = maximum height = $-0.8(6.5)^2 + 10.4(6.5) + 6 = 39.8$

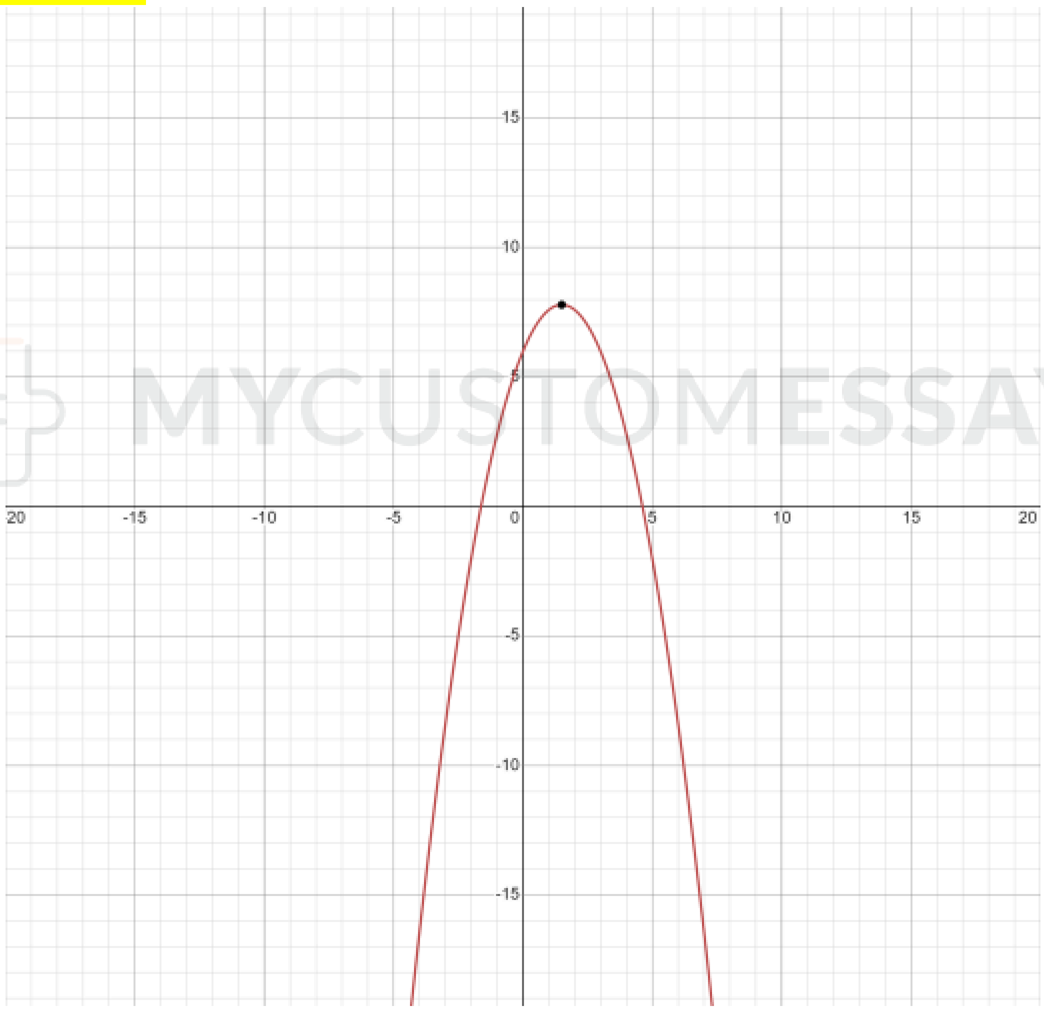
Distance from where it was thrown that maximum height occurs = 6.5 feet

b. **ANSWER: Distance ball travels before hitting ground = 13.6 feet**

$x = -10.4 \pm \text{sqrt}(10.4^2 - 4(-0.8)(6)) / (2*-0.8)$

x = 13.6

c. **ANSWER**



5) The degree of a polynomial is the highest degree of its terms.

$-2x^5 \rightarrow 5$
$7x^2 \rightarrow 2$
$1 \rightarrow 0$

ANSWER: $f(x) = 7x^2 – 2x^5 +1$

6) The degree of the function is 4, which is even. This means that the function will point in the same direction.

The leading coefficient is -5, which is negative. This means that the graph will fall to the right.

ANSWER: B. The graph of f(x) falls to the left and falls to the right.

7) a. **ANSWER: The leading coefficient is 41, which is positive. This means that the graph rise to the right.**

b. $-x^2 + 4 = 0 \rightarrow -x^2/-x = -4/-x \rightarrow x^2 = 4 \rightarrow x = +/-$ sqrt(4) $\rightarrow x = -2, 2$

$x^2 = 0 \rightarrow x = 0$

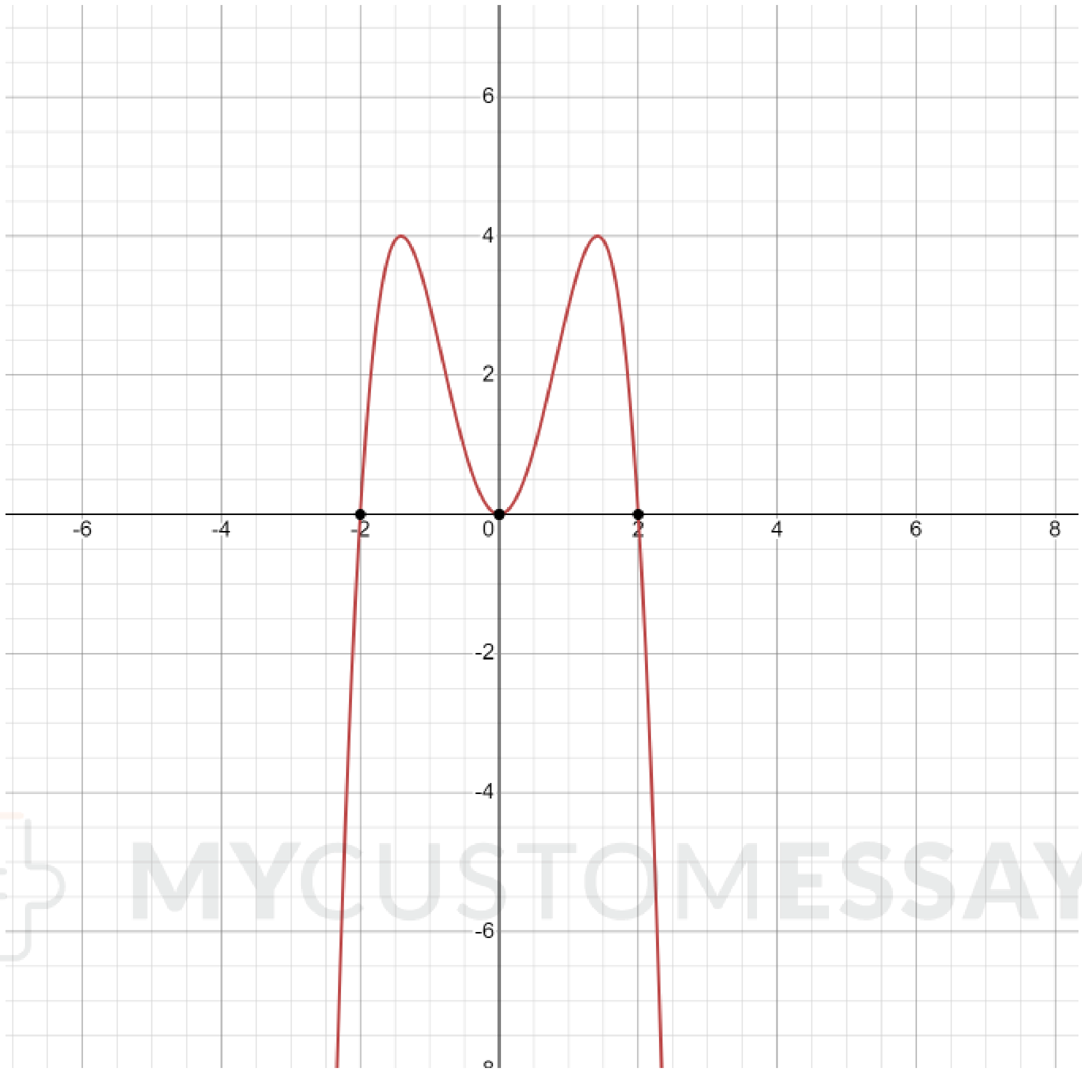
$y = -(0)^4 + 4(0)^2 = 0$

ANSWER: X-intercepts = 0, 2, -2 ; Touches the x-axis and turns around at each intercept.

c. $y = -(0)^4 + 4(0)^2 = 0$

ANSWER: Y-intercept = 0

d. **ANSWER: The graph does not have an axis of symmetry.**
e. **ANSWER:**



8) a. $f(40) = 0.76(40)^2 – 30(40)^2 – 882(40) + 37807$
$= 1216 – 48000 – 35820 + 37807$
$= -44257$

ANSWER: The interpretation of f(40) would be displayed as a point on the graph as (40, 44257).

b. **ANSWER: In the actual data shown by the bar graph, f(40) underestimates. The underestimation is 6,757 tigers (44257 – 37500).**

c. The leading coefficient is -29.24 ($-29.24x^2 – 882x + 37807$).

ANSWER: Since the leading coefficient is negative, the graph will fall to the right. The function will be useful in modeling the world tiger population if

conservation efforts to save wild tigers fail because it will showcase the population decline.

9) $$x^2+x-2\overline{)x^4+2x^3-4x^2-5x-6}$$

$$\begin{array}{r} x^2 \\ x^2+x-2\overline{)x^4+2x^3-4x^2-5x-6} \end{array}$$

$$\begin{array}{r} x^2 \\ x^2+x-2\overline{)\ x^4+2x^3-4x^2-5x-6} \\ \underline{+x^4+x^3\ \ -2x^2} \end{array}$$

$$\begin{array}{r} x^2 \\ x^2+x-2\overline{)\ x^4+2x^3-\ 4x^2-5x-6} \\ \underline{-x^4-\ x^3\ \ +2x^2} \end{array}$$

$$\begin{array}{r} x^2 \\ x^2+x-2\overline{)\ x^4+2x^3-\ 4x^2-5x-6} \\ \underline{-x^4-\ x^3\ \ +2x^2} \\ +x^3\ -\ 2x^2 \end{array}$$

$$\begin{array}{r} x^2 \\ x^2+x-2\overline{)\ x^4+2x^3-\ 4x^2-5x-6} \\ \underline{-x^4-\ x^3\ \ +2x^2} \\ +x^3\ -\ 2x^2-5x \end{array}$$

$$\begin{array}{r} x^2+x \\ x^2+x-2\overline{)\ x^4+2x^3-\ 4x^2-5x-6} \\ \underline{-x^4-\ x^3\ \ +2x^2} \\ +x^3\ -\ 2x^2-5x \end{array}$$

$$\begin{array}{r} x^2+x \\ x^2+x-2\overline{)\ x^4+2x^3-\ 4x^2-5x-6} \\ \underline{-x^4-\ x^3\ \ +2x^2} \\ +x^3\ -\ 2x^2-5x \\ \underline{+x^3\ \ +x^2\ \ -2x} \end{array}$$

$$
\begin{array}{r|l}
 & x^2+x \\
\hline
x^2+x-2 & x^4+2x^3-4x^2-5x-6 \\
 & \underline{-x^4-x^3+2x^2} \\
 & \quad +x^3-2x^2-5x \\
 & \quad \underline{-x^3-x^2+2x} \\
 & \quad - \quad - \quad\quad -
\end{array}
$$

$$
\begin{array}{r|l}
 & x^2+x \\
\hline
x^2+x-2 & x^4+2x^3-4x^2-5x-6 \\
 & \underline{-x^4-x^3+2x^2} \\
 & \quad +x^3-2x^2-5x \\
 & \quad \underline{-x^3-x^2+2x} \\
 & \quad\quad -3x^2-3x
\end{array}
$$

$$
\begin{array}{r|l}
 & x^2+x \\
\hline
x^2+x-2 & x^4+2x^3-4x^2-5x-6 \\
 & \underline{-x^4-x^3+2x^2} \\
 & \quad +x^3-2x^2-5x \\
 & \quad \underline{-x^3-x^2+2x} \\
 & \quad\quad -3x^2-3x-6
\end{array}
$$

$$
\begin{array}{r|l}
 & x^2+x-3 \\
\hline
x^2+x-2 & x^4+2x^3-4x^2-5x-6 \\
 & \underline{-x^4-x^3+2x^2} \\
 & \quad +x^3-2x^2-5x \\
 & \quad \underline{-x^3-x^2+2x} \\
 & \quad\quad -3x^2-3x-6 \\
 & \quad\quad \underline{-3x^2-3x+6}
\end{array}
$$

$$
\begin{array}{r|l}
 & x^2+x-3 \\
\hline
x^2+x-2 & x^4+2x^3-4x^2-5x-6 \\
 & \underline{-x^4-x^3+2x^2} \\
 & \quad +x^3-2x^2-5x \\
 & \quad \underline{-x^3-x^2+2x} \\
 & \quad\quad -3x^2-3x-6 \\
 & \quad\quad \underline{+3x^2+3x-6}
\end{array}
$$

$$
\begin{array}{r|l}
 & x^2+x\quad -3 \\
\hline
x^2+x-2 & x^4+2x^3-4x^2-5x-6 \\
 & -x^4-x^3\ +2x^2 \\
\hline
 & \quad +x^3\ -2x^2-5x \\
 & \quad -x^3\ -x^2\ +2x \\
\hline
 & \qquad -3x^2-3x-6 \\
 & \qquad +3x^2+3x-6 \\
\hline
 & \qquad\qquad -12
\end{array}
$$

$$x^2+x-3-\frac{12}{x^2+x-2}$$

ANSWER: Quotient → x^2 + x – 3 ; Remainder → -12

$$
\begin{array}{r|rrrrr}
-5 & 1 & -5 & 1 & -5 & 0 \\
 & & & & & \\
\hline
\end{array}
$$

10)

$$
\begin{array}{r|rrrrr}
-5 & 1 & -5 & 1 & -5 & 0 \\
 & & & & & \\
\hline
 & 1 & & & &
\end{array}
$$

$$
\begin{array}{r|rrrrr}
-5 & 1 & -5 & 1 & -5 & 0 \\
 & & -5 & & & \\
\hline
 & 1 & & & &
\end{array}
$$

$$
\begin{array}{r|rrrrr}
-5 & 1 & -5 & 1 & -5 & 0 \\
 & & -5 & 50 & & \\
\hline
 & 1 & -10 & & &
\end{array}
$$

$$
\begin{array}{r|rrrrr}
-5 & 1 & -5 & 1 & -5 & 0 \\
 & & -5 & 50 & & \\
\hline
 & 1 & -10 & 51 & &
\end{array}
$$

$$
\begin{array}{r|rrrrr}
-5 & 1 & -5 & 1 & -5 & 0 \\
 & & -5 & 50 & -255 & \\
\hline
 & 1 & -10 & 51 & &
\end{array}
$$

$$\begin{array}{r|rrrrr} -5 & 1 & -5 & 1 & -5 & 0 \\ & & -5 & 50 & -255 & \\ \hline & 1 & -10 & 51 & -260 & \end{array}$$

$$\begin{array}{r|rrrrr} -5 & 1 & -5 & 1 & -5 & 0 \\ & & -5 & 50 & -255 & 1300 \\ \hline & 1 & -10 & 51 & -260 & \end{array}$$

$$\begin{array}{r|rrrrr} -5 & 1 & -5 & 1 & -5 & 0 \\ & & -5 & 50 & -255 & 1300 \\ \hline & 1 & -10 & 51 & -260 & 1300 \end{array}$$

$$1x^3 + -10x^2 + (51)\,x - 260 + \frac{1300}{x+5}$$

$$x^3 - 10x^2 + 51x - 260 + \frac{1300}{x+5}$$

ANSWER: Quotient → $x^3 - 10x^2 + 51x - 260$; Remainder → 1300

11) a. $2(2)^3 + 14(2)^2 - 72 = 0$

$0 = 0$

ANSWER: 2 is a solution of the polynomial equation because the equation has a remainder of 0.

b. $(x)(2x)(x+7) = 72$

$2x^3 + 14x^2 = 72$

$2x^3 + 14x^2 - 72 = 0$

$2\,(x^3 + 7x^2 - 36) = 0$

$$\begin{array}{r|rrrr} 2 & 1 & 7 & 0 & -36 \\ & & 2 & 18 & 36 \\ \hline & 1 & 9 & 18 & 0 \end{array}$$

$(x-2)(x^2+9x+18)=0$

$(x-2)(x+6)(x+3)=0$

x = 2, -6, -3

ANSWER: Height = 2 in.; Width = 4 in.; Length = 9 in.

12)

a) as $x \to 1^+$ $f(x) \to \infty$

b) as $x \to 1^-$, $f(x) \to -\infty$

c) as $x \to -2^+$, $f(x) \to -\infty$

d) as $x \to -2^-$, $f(x) \to \infty$

e) as $x \to \infty$, $f(x) \to$ $\boxed{1}$

f) as $x \to -\infty$, $f(x) \to$ $\boxed{1}$

Since $\frac{x-3}{x^2-9} \to -\infty$ as $x \to -3$ from the left and $\frac{x-3}{x^2-9} \to \infty$ as $x \to -3$ from the right, then $x = -3$ is a vertical asymptote.

13) $x = -3$

f(x) = (x-3)/(x+3)(x-3)
f(x) = 1/x+3
x-3 = 0
x =3

1 / 3+3
1/6

ANSWERS: Vertical asymptote → x = -3 ; Holes → 3, 1/6

14) y = a/b → a = 12; b = 3; y = 4

ANSWER: The horizontal asymptote is y = 4.