Outline

1. Polynomials.
2. Quadratics.
3. Rational functions.
4. Composite functions.
5. Sine and cosine.

1. Polynomials

$$q(x) = k(x - -2)^3 \cdot (x-1)^2 \cdot (x-3)$$

④ Find value of k.

- Need coordinates of point from graph that is <u>not</u> a root.

$$x = 0 \qquad y = -1.$$

$$q(x) = -1.$$

$$-1 = k \cdot (0 - -2)^3 \cdot (0-1)^2 \cdot (0-3)$$

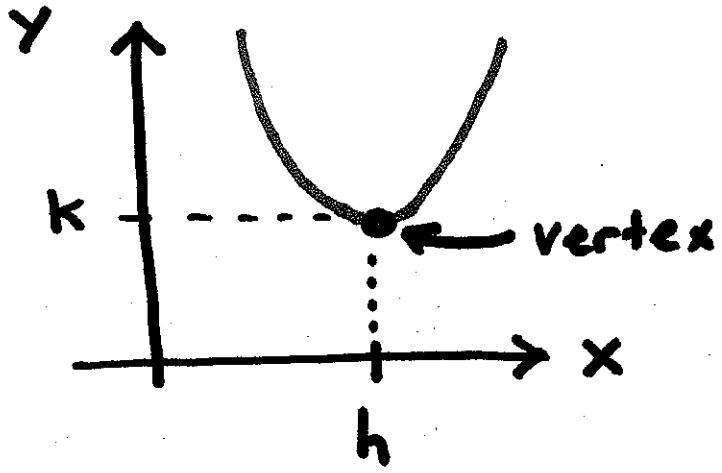
$$-1 = k \cdot (-24)$$

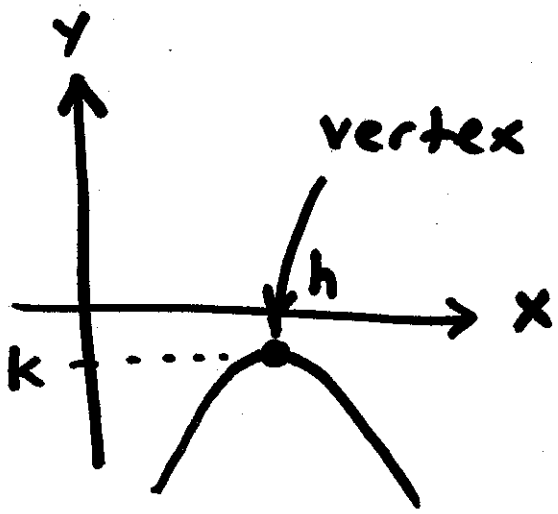
$$\frac{1}{24} = k.$$

Final answer:

$$q(x) = \frac{1}{24}(x+2)^3 \cdot (x-1)^2 \cdot (x-3)$$

2. Quadratics that Don't Cross the x-axis



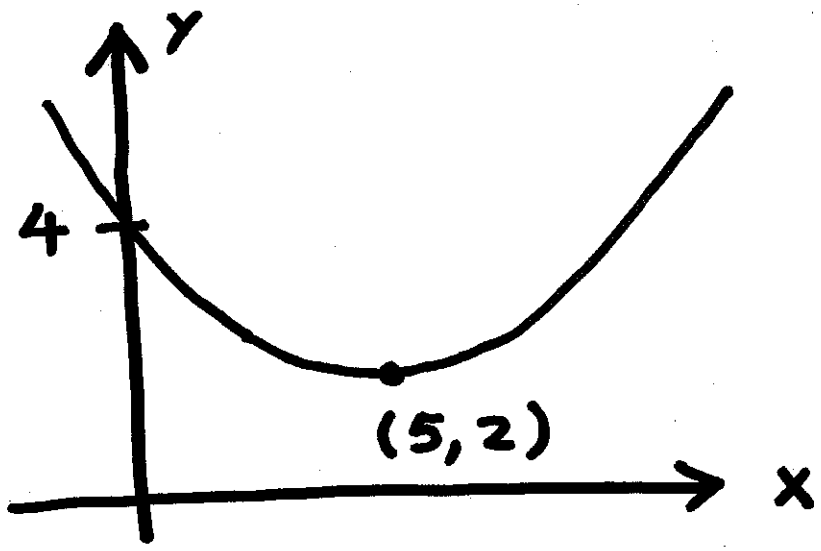


Vertex Form: $y = a \cdot (x-h)^2 + k$

- a: constant of proportionality.
- h: x-coord of vertex
- k: y-coord of vertex.

Example

Find a formula for the quadratic graphed below.



Solution:

$$y = a \cdot (x-5)^2 + 2$$

To find 'a' plug in $x=0$ $y=4$.

$$4 = a \cdot (0-5)^2 + 2$$

↓ minus 2 both sides

$$2 = a \cdot (25)$$

↓ ÷ both sides by 25.

$$\frac{2}{25} = a$$

Final answer: $y = \frac{2}{25}(x-5)^2 + 2.$

3. Rational Functions

- Functions whose formula can be expressed as a fraction with a polynomial in the numerator and a polynomial in the denominator.

Example

$$R(x) = \frac{x^2 - 4}{x + 2} \qquad L(x) = x - 2.$$

Are these different or the same?

Solution

$$R(x) = \frac{(x-2)(x+2)}{(x+2)} \overset{???}{=} x-2$$

They are different because at one point ($x = -2$), the $R(x)$

formula looks like $\frac{0}{0}$, which is undefined. So $x = -2$ is not in the domain of $R(x)$. But $x = -2$ is in the domain of $L(x)$. Since $R(x)$ and $L(x)$ have different domains they are different functions even though their values agree at every x-value except $x = -2$.

4. Composite Functions

- Put two functions together to create a new function by using the output of one function as the input to the next function.

Example

$f(x) = 7 + \sqrt{x}$

$g(x) = x^2 + 4x + 9.$

Find formulas for:

(a) $f(g(x))$ (b) $g(f(x))$

(c) $g(g(x))$.

Solution

(a) ① Write outermost formula with parentheses around each x present.

outer formula: $f(x) = 7 + \sqrt{x}$

$f(\quad(x)\quad) = 7 + \sqrt{\quad(x)\quad}$

② Erase x's leaving parentheses there.

$f(\quad) = 7+\sqrt{\quad}$

③ Within each set of parentheses write the formula of the innermost function.

$f((x^2+4x+9)) = 7+\sqrt{(x^2+4x+9)}$

$f(g(x)) = 7+\sqrt{x^2+4x+9}$

(b) $g(f(x))$.

$g(x) = x^2 + 4x + 9$

$g((x)) = (x)^2 + 4(x) + 9$

$g((\quad)) = (\quad)^2 + 4(\quad)+9$

$g((7+\sqrt{x})) = (7+\sqrt{x})^2 + 4(7+\sqrt{x}) + 9$

$g(f(x)) = (7+\sqrt{x})^2 + 4(7+\sqrt{x}) + 9$

(c) $g(g(x))$

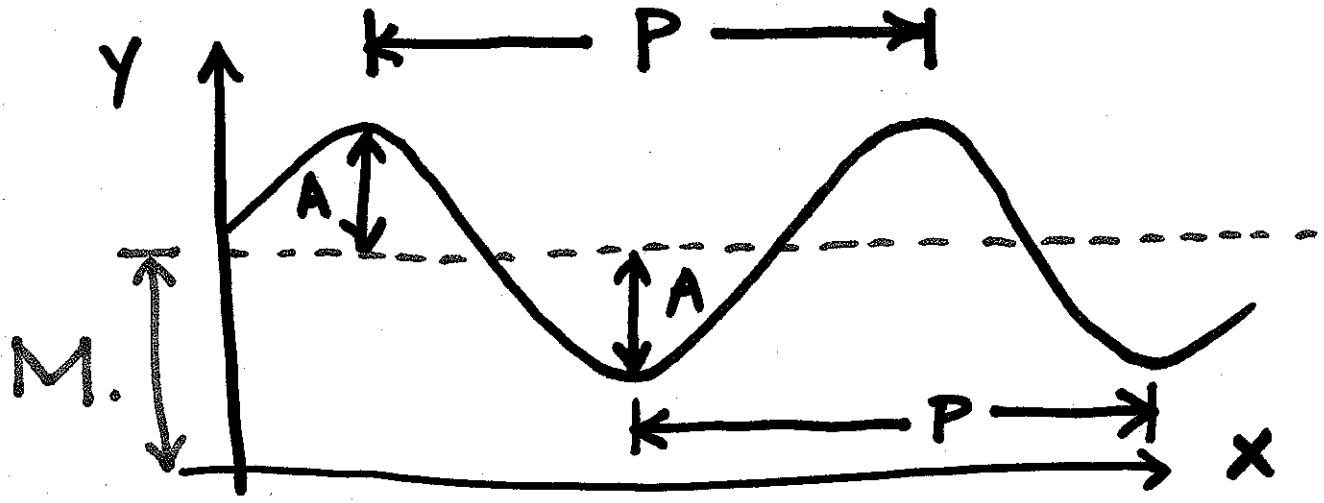
$g((\quad)) = (\quad)^2 + 4(\quad) + 9$

$g((x^2+4x+9)) = (x^2+4x+9)^2 + 4(x^2+4x+9) + 9$

5. Sine and Cosine

Three important numbers for sine and cosine graphs:

- M = midline (y-value splitting graph in two)
- A = amplitude (maximum deviation of graph from midline).
- P = period (horizontal distance between peaks on graph.).


Y
P
A
A
M.
P
X