

REVISING FUNCTIONS & ALGEBRA

09 JUNE 2014



Lesson Description

In this lesson we:

- Revise Functions and Algebra



Summary

Parabolic Functions

Standard form: $f(x) = ax^2 + bx + c$

- y - intercept: $(0; c)$
- x - intercept: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- Axis of symmetry; $x = -\frac{b}{2a}$
- Turning point: $\left(-\frac{b}{2a}; f\left(-\frac{b}{2a}\right)\right)$

Completed square form: $f(x) = a(x + p)^2 + q$

- Turning point: $(-p; q)$
- $p > 0$: horizontal shift left
- $p < 0$: horizontal shift right
- $q > 0$: vertical shift up
- $q < 0$: vertical shift down

Hyperbolic Function

Standard form: $y = \frac{k}{x + p} + q$

- $p > 0$: horizontal shift left
- $p < 0$: horizontal shift right
- $q > 0$: vertical shift up
- $q < 0$: vertical shift down
- Asymptotes: $x = -p$ and $y = q$

Exponential Function

Standard form: $y = ab^{x+q} + p$

- $p > 0$: horizontal shift left
- $p < 0$: horizontal shift right
- Asymptotes: $y = p$

Exponential Laws

- $a^m \cdot a^n = a^{m+n}$
- $\frac{a^m}{a^n} = a^{m-n}$
- $(a^m)^n = a^{mn}$
- $(ab)^m = a^m b^m$
- $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
- $\sqrt[n]{a^m} = a^{\frac{m}{n}}$

Nature of Roots

- Standard form: $ax^2 + bx + c = 0$
- $\Delta = b^2 - 4ac$
- Real: $\Delta \geq 0$
- Equal: $\Delta = 0$
- Rational: $\Delta = \text{perfect square}$
- Irrational: $\Delta \neq \text{perfect square}$
- Non-real/Imaginary
- $\Delta < 0$



Test Yourself

Question 1

The equation of a curve is $y = ab^x$. It is given that the curve passes through the point $(1, 4)$, $(m, 16)$ and $(4, 32)$. Calculate the values of a , b and m .

- A. $a = 1, b = 4, m = 2$
- B. $a = 0.25, b = 16, m = 1.5$
- C. $a = 2, b = 2, m = 3$
- D. $a = 1, b = 4, m = 3.5$

Question 2

Solve for the value of x in $\frac{(s-t^2)^4}{(s-t^2)^x} = (s-t^2)^{5x-7}$

- A. $\frac{11}{6}$
- B. $\frac{5}{4}$
- C. $\frac{3}{2}$
- D. $-\frac{6}{5}$

Question 3

What is the line of symmetry for the graph of $y = (x-h)^2 + k$?

- A. $x = k$
- B. $x = h$
- C. $y = k$
- D. $y = -h$

Question 4

Find the coordinates of the turning point of the graph of $y = -(x-2)(x-6)$ and determine if the turning point is maximum or minimum.

- A. $(2, 6)$, maximum
- B. $(2, 6)$, minimum
- C. $(4, 4)$, minimum
- D. $(4, 4)$, maximum

Question 5

Solve the equation $\sqrt{2x+1} - \sqrt{x-3} = 2$.

- A. $x = \frac{7}{2}$ or $x = -1$
- B. $x = 2$
- C. $x = 12$ or $x = 4$
- D. $x = 0$

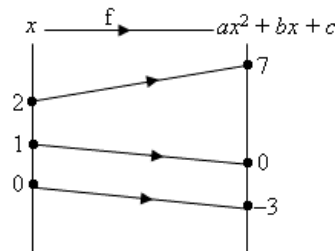
Question 6

four equations describing different relations are listed below. By sketching their graphs or otherwise, determine which relation is not a function.

- A. $y = x + 7$
- B. $y = x^2$
- C. $x = 20$
- D. $y = 7$

Question 7

A function is defined by $f(x) = ax^2 + bx + c$ and the diagram below shows apart of the mapping. Find the values of a, b and c respectively.



- A. 2, -1, -3
- B. 2, 1, -3
- C. -2, 1, 3
- D. -2, -1, -3

Question 8

Find the range of values of values of the constant p , given that the quadratic equation $2x^2 + px + 18 = 0$ has no real roots.

- A. $-2 < p < 9$
- B. $-9 < p < 2$
- C. $-12 < p < 12$
- D. $p < -12$ or $p > 12$

Question 9

Find the range of values of p , where p is a constant, if the quadratic equation $5(4px^2 + 1) = 8(p+1)x$ has no real roots.

- A. $p < -4$ or $p > \frac{1}{4}$
- B. $\frac{1}{4} < p < 4$
- C. $p < -\frac{1}{4}$ or $p > 4$
- D. $-4 < p < -\frac{1}{4}$

Question 10

Find the range of values of k for which the line $y = 4x + 7$ cuts the curve $y = -x^2 + kx + k$ at two distinct points.

- A. $k < -2$ or $k > 6$
- B. $k < -2$ or $k > 6$
- C. $k < -4$ or $k > 3$
- D. $k < -3$ or $k > 4$

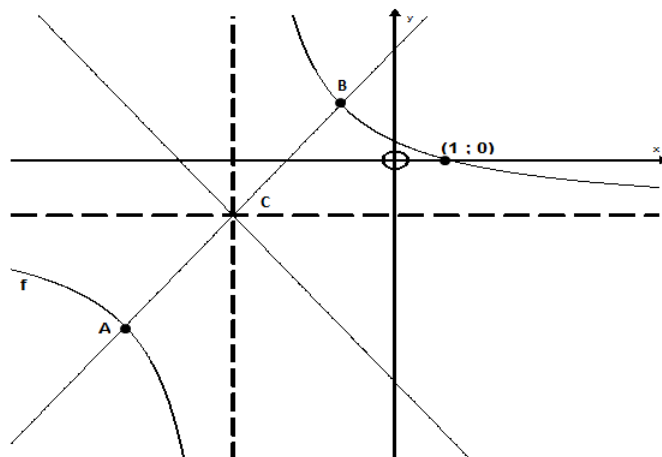


Improve your Skills

Question 1

In the sketch alongside is:

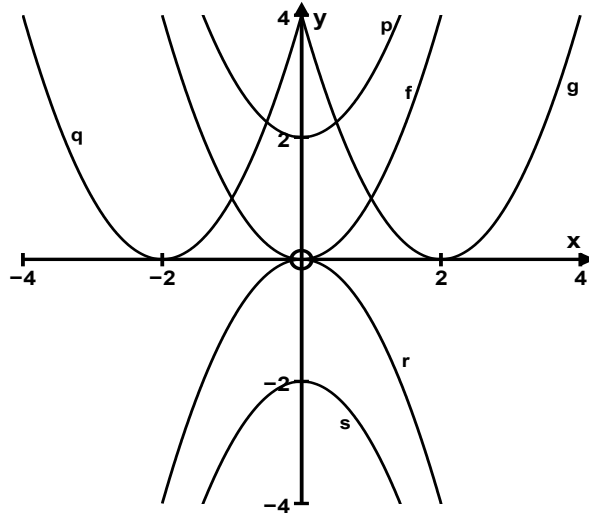
- $f(x) = \frac{a}{x-p} + q$
- C is the point of intersection of the axes of symmetry of $f : y = x + 2$ and $y = -x - 4$
- f passes through the point $(1 ; 0)$



- 1.1) Find the coordinates of C.
- 1.2) Find the equation of f

Question 2

The graph of f is defined by $f(x) = x^2$. Identify the graph that represents the following transformations of f :



2.1) $f(x - 2)$

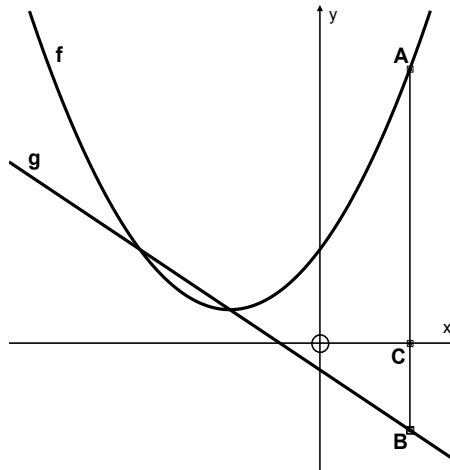
2.2) $f(x) + 2$

2.3) $-f(x)$

Question 3

Given: $f(x) = x^2 + 6x + 14$ and $g(x) = -3x - 4$

and $AB = 54$



Calculate OC

Question 4

Simplify the following:

a)
$$\frac{3^x + 3^x + 3^x + 3^x}{3^{4+x}}$$

b)
$$\frac{10\sqrt{2x^{20}} + 7\sqrt{8x^{20}}}{\sqrt{18x^{20}}}$$

Question 5For which value(s) of x will the expression $\sqrt{\frac{x+1}{x-4}}$ be real?**Question 6**Determine the values of k if the equation $x + 2 + 2k = \frac{9}{x} + kx$ has equal roots.