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September 25, 2016 12:17 PM

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Section 1.2 Quadratic Functions in Standard Form $y=a(x-p)^2+q$

1. In each of the quadratic function below, indicate the values of the constant "a", "p" , "q" and the coordinate of the vertex for a quadratic function in the form of: $y=a(x-p)^2+q$.

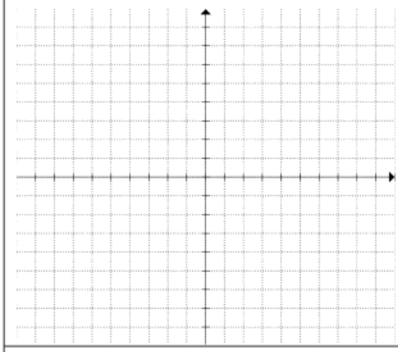
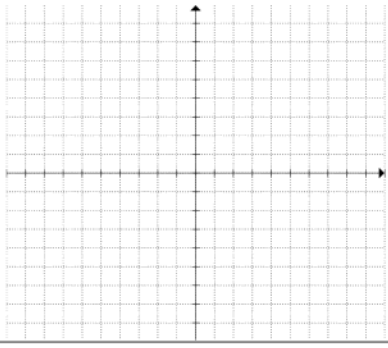
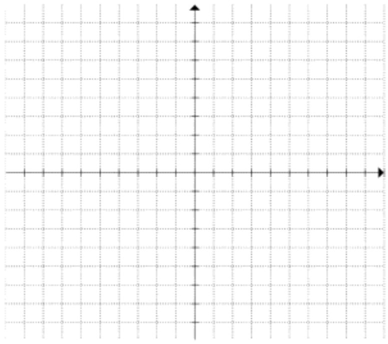
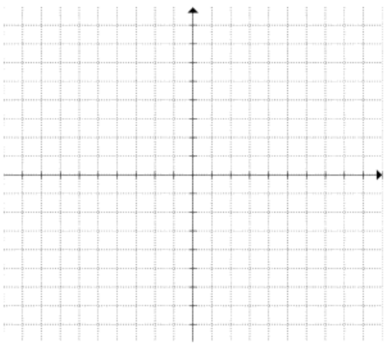
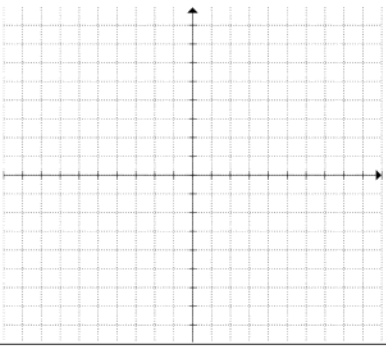
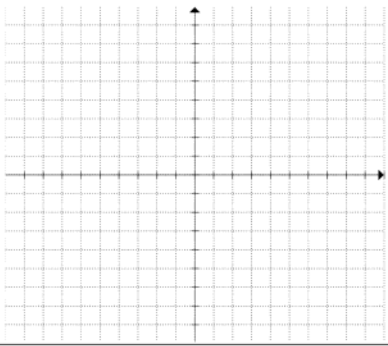
Equation	Constants "a", "p" and "q"	Vertex (Coord)	Equation	Constants "a", "p" and "q"	Vertex (Coord)
a) $y=2(x-3)^2+4$			g) $y=9(x+5)^2+7$		
b) $y=-3(x+0.75)^2+6$			h) $y=-4x^2+10$		
c) $y=-\frac{2}{3}(x-1)^2-2$			i) $y=-3\left(x+\frac{2}{3}\right)^2-2$		
d) $y=(-3x)^2+2$			j) $y=\frac{3(x-11)^2+4}{2}$		
e) $y=(2x-1)^2-3$			k) $y=(3x+1)^2+8$		
f) $y=(3x-6)^2-8$			L) $y=4x^2+4x+9$		

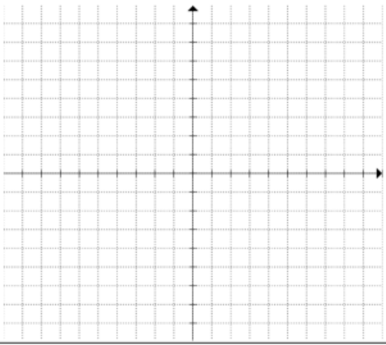
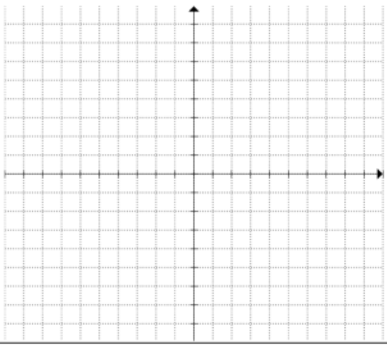
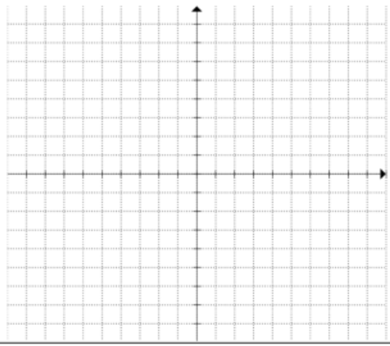
2. Factor each of the following quadratic functions and find i) the Coordinates of the Roots, ii) the Equation of the Axis of Symmetry, iii) Coordinates of the Vertex, iii) Domain and Range

a) $y = x^2 - 5$ $Roots:$ $A\ of\ S:$ $Vertex:$ $Range:$	b) $y = -2(x+2)^2$ $Roots:$ $A\ of\ S:$ $Vertex:$ $Range:$	c) $y = 5(x-5)^2 - 10$ $Roots:$ $A\ of\ S:$ $Vertex:$ $Range:$
d) $y = 7x^2 - 14$ $Roots:$ $A\ of\ S:$ $Vertex:$ $Range:$	e) $y = (4x-4)^2 - 10$ $Roots:$ $A\ of\ S:$ $Vertex:$ $Range:$	f) $y = 5(3x)^2$ $Roots:$ $A\ of\ S:$ $Vertex:$ $Range:$
g) $y = \dfrac{(5x-5)^2 + 15}{5}$	h) $y = -2(3-x)^2 - 14$	i) $y = \dfrac{2\sqrt{(x^4 + 4x^2 + 16)} + 4}{-2} - 1$

Roots : *A of S* : *Vertex* : *Range* :	*Roots* : *A of S* : *Vertex* : *Range* :	*Roots* : *A of S* : *Vertex* : *Range* :

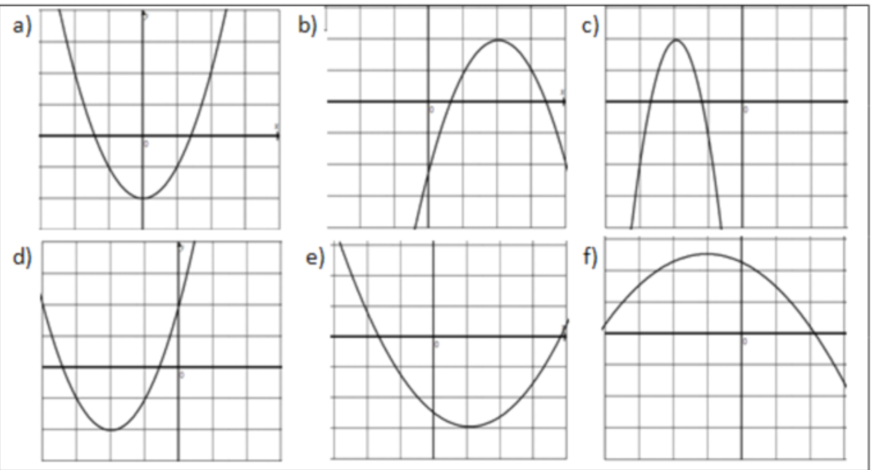
3. Graph the following quadratic functions and label the Roots, Axis of Symmetry, Vertex, and Y-intercepts:

a) $y=(x-4)^2-9$ 	b) $y=-3(x+2)^2+8$ 	b) $y=\frac{1}{3}(x+3)^2+1$ 
c) $y=-\frac{1}{2}(x-2)^2+7$ 	d) $y=\frac{(2x-4)^2+8}{8}$ 	e) $y=(3x-15)^2-6$ 

e) $y = 2(2x-6)^2 + 3$ 	f) $y = \frac{(3x-9)^2 + 3}{3} + 2$ 	g) $y = \sqrt{\frac{(x^4 - 8x^2 + 16)}{4}} + 4$ 

4. If each parabola is in the form of $y = a(x-p)^2 + q$, then which graph best describes each equation:

i) $a < -1, p < 0, q > 0$	
ii) $0 < a < 1, p > 0, q < 0$	
iii) $a > 0, p = 0, q < 0$	
iv) $0 > a > -1, p < 0, q > 0$	

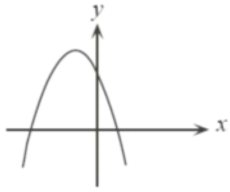


5. Convert the function $y = \frac{1}{2}x^2 - 4x + 1$ into standard form.

6. If a ball is thrown upward from a height of 4 metres with an initial velocity of 6 m/s, its height, H(t), after t seconds is given by the equation $H(t) = -0.5t^2 + 6t + 4$. Determine the maximum height of the ball.

7. The graph of the function $y = ax^2 + bx + c$ is shown in the diagram. Which of the following statements below must be positive?

a) a b) bc c) ab^2 d) $b - c$ e) $c - a$



8. Consider the parabola $y = 5x^2 - 4x + c$. The value of the real number "c" for which such a parabola touches the x-axis exactly once is: [BCSSM 2008]

a) $-\frac{4}{5}$ b) 0 c) $\frac{2}{5}$ d) $\frac{4}{5}$ e) $\frac{\sqrt{5}}{4}$

9. Point "A" and "B" are on the parabola $y = 4x^2 + 7x - 1$, and the origin is the midpoint of $\overline{AB}$. What is the length of $\overline{AB}$?

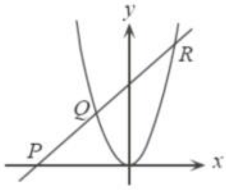
10. The parabola $y = x^2 - 2x + 4$ is moved *'p"* units to the right and *"q"* units down. The x-intercepts of the resulting parabola are 3 and 5. What are the values of *"p"* and *"q"*?

11. If $y = a(x-2)^2 + c$ and $y = (2x-5)(x-b)$ represents the same quadratic function, what is the value of the constant "b"

12. The parabola $y = ax^2 + bx + c$ has vertex (p, p) and y-intercept $(0, -p)$, where $p \neq 0$, what is the value of "b"? a) $-p$ b) 0 c) 2 D) 4 E) p

13. The parabola $y = x^2 - 2x + 4$ is moved *'p"* units to the right and *"q"* units down. The x-intercepts of the resulting parabola are 3 and 5. What are the values of "*p*" and "*q*"?

14. A line with slope 1 passes through the point "P" on the negative x-axis as shown and intersects the parabola $y = x^2$ at points Q and R. If $PQ = RQ$, then what is the y-intercept of line PR?



15. Challenge: The parabola $y = f(x) = x^2 + bx + c$ has vertex "P" and the parabola $y = g(x) = -x^2 + dx + e$ has vertex "Q", where "P" and "Q" are distinct points. The two parabolas also intersect at "P" and "Q".

i) Prove that $2(e-c) = bd$.

ii) Prove that the line through points "P" and "Q" has slope $\frac{1}{2}(b+d)$ and y-intercept $\frac{1}{2}(c+e)$