# Chp 1 Quadratics Exam Qs

**1a.** *[1 mark]*

Write down the equation of the axis of symmetry.

## Markscheme

 (must be an equation) ***A1 N1***

***[1 mark]***

**1b.** *[2 marks]*

The function *f* can be written in the form  .

Write down the value of *h* and of *k* .

## Markscheme

 , ***A1A1 N2***

***[2 marks]***

**1c.** *[3 marks]*

The function *f* can be written in the form  .

Find *a* .

## Markscheme

attempt to substitute coordinates of any point on the graph into *f* ***(M1)***

e.g.  ,  , 

correct equation (do **not** accept an equation that results from  ) ***(A1)***

e.g.  , 

***A1 N2***

***[3 marks]***

**2a.** *[2 marks]*

Write down  in the form  .

## Markscheme

 ***A1A1 N2***

***[2 marks]***

**2b.** *[4 marks]*

Find another expression for  in the form  .

## Markscheme

**METHOD 1**

attempting to find the *x*-coordinate of maximum point ***(M1)***

e.g. averaging the *x*-intercepts, sketch,  , axis of symmetry

attempting to find the *y*-coordinate of maximum point  ***(M1)***

e.g. 

***A1A1 N4***

**METHOD 2**

attempt to expand ***(M1)***

e.g. 

attempt to complete the square ***(M1)***

e.g. 

***A1A1 N4***

***[4 marks]***

**2c.** *[2 marks]*

Show that  can also be written in the form  .

## Markscheme

attempt to simplify ***(M1)***

e.g. distributive property, 

correct simplification ***A1***

e.g.  , 

***AG N0***

***[2 marks]***

**2d.** *[7 marks]*

A particle moves along a straight line so that its velocity,  , at time *t* seconds is given by  , for  .

(i) Find the value of *t* when the speed of the particle is greatest.

(ii) Find the acceleration of the particle when its speed is zero.

## Markscheme

(i) valid approach ***(M1)***

e.g. vertex of parabola, 

***A1 N2***

(ii) recognizing ***(M1)***

***A1A1***

speed is zero ***(A1)***

 () ***A1 N3***

***[7 marks]***

**3a.** *[3 marks]*

Express  in the form  .

## Markscheme

evidence of obtaining the vertex ***(M1)***

e.g. a graph,  , completing the square

***A2 N3***

***[3 marks]***

**3b.** *[1 mark]*

Write down the equation of the axis of symmetry of the graph of *f* .

## Markscheme

 (equation must be seen) ***A1 N1***

***[1 mark]***

**3c.** *[2 marks]*

Express  in the form  .

## Markscheme

***A1A1 N2***

***[2 marks]***

**4a.** *[2 marks]*

Show that  .

## Markscheme

***A1***

***A1***

***AG N0***

***[2 marks]***

**4b.** *[8 marks]*

For the graph of *f*

(i) write down the coordinates of the vertex;

(ii) write down the **equation** of the axis of symmetry;

(iii) write down the *y*-intercept;

(iv) find both *x*-intercepts.

## Markscheme

(i) vertex is  ***A1A1 N2***

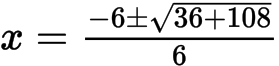
(ii)  (**must** be an equation) ***A1 N1***

(iii) ***A1 N1***

(iv) evidence of solving ***(M1)***

e.g. factorizing, formula,

correct working ***A1***

e.g.  , 

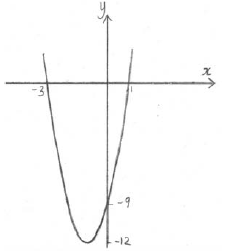
, ***A1A1 N1N1***

***[8 marks]***

**4c.** *[2 marks]*

**Hence** sketch the graph of *f* .

## Markscheme

 ***A1A1 N2***

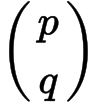
**Note**: Award ***A1*** for a parabola opening upward, ***A1*** for vertex and intercepts in approximately correct positions.

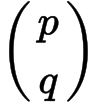
***[2 marks]***

**4d.** *[3 marks]*

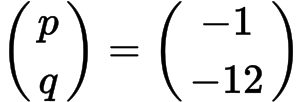
Let  . The graph of *f* may be obtained from the graph of *g* by the two transformations:

a stretch of scale factor *t* in the *y*-direction

followed by a translation of  .

Find  and the value of *t*.

## Markscheme

 , (accept  ,  ,  ) ***A1A1A1 N3***

***[3 marks]***

**5a.** *[4 marks]*

Find both *x*-intercepts.

## Markscheme

evidence of attempting to solve ***(M1)***

evidence of correct working ***A1***

e.g.  , 

intercepts are  and  (accept  ,  ) ***A1A1 N1N1***

***[4 marks]***

**5b.** *[2 marks]*

Find the *x*-coordinate of the vertex.

## Markscheme

evidence of appropriate method ***(M1)***

e.g.  ,  , reference to symmetry

***A1 N2***

***[2 marks]***

**6a.** *[4 marks]*

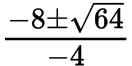
Find the *x*-intercepts of the graph.

## Markscheme

evidence of setting function to zero  ***(M1)***

e.g.  , 

evidence of correct working ***A1***

e.g.  , 

*x*-intercepts are at 4 and 0 (accept (4, 0) and (0, 0) , or  ,  ) ***A1A1 N1N1***

***[4 marks]***

**6b.** *[3 marks]*

(i) Write down the equation of the axis of symmetry.

(ii) Find the *y*-coordinate of the vertex.

## Markscheme

(i)  (must be equation) ***A1 N1***

(ii) substituting  into ***(M1)***

***A1 N2***

***[3 marks]***

**7a.** *[2 marks]*

Show that  .

## Markscheme

***A1***

***A1***

***AG N0***

***[2 marks]***

**7b.** *[7 marks]*

For the graph of *f*

(i) write down the coordinates of the vertex;

(ii) write down the *y*-intercept;

(iii) find both *x*-intercepts.

## Markscheme

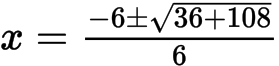
(i) vertex is ***A1A1 N2***

(ii)  , or ***A1 N1***

(iii) evidence of solving ***M1***

e.g. factorizing, formula

correct working ***A1***

e.g.  , 

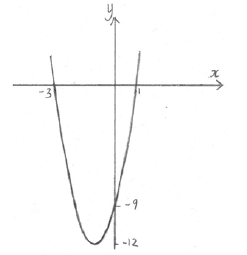
 ,  , or ***A1A1 N2***

***[7 marks]***

**7c.** *[3 marks]*

**Hence** sketch the graph of *f* .

## Markscheme

 ***A1A1A1 N3***

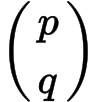
**Note**: Award ***A1*** for a parabola opening upward, ***A1*** for vertex in approximately correct position, ***A1*** for intercepts in approximately correct positions. Scale and labelling not required.

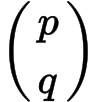
***[3 marks]***

**7d.** *[3 marks]*

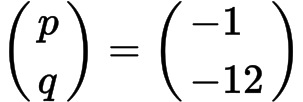
Let  . The graph of *f* may be obtained from the graph of *g* by the following two transformations

a stretch of scale factor *t* in the *y*-direction,

followed by a translation of  .

Write down and the value of *t* .

## Markscheme

 , ***A1A1A1 N3***

***[3 marks]***

**8.** *[6 marks]*

The equation  has two distinct real roots. Find the possible values of *k* .

## Markscheme

evidence of rearranged quadratic equation (may be seen in working) ***A1***

*e.g.*  , 

evidence of discriminant (must be seen explicitly, not in quadratic formula) ***(M1)***

*e.g*.  , 

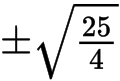
recognizing that discriminant is greater than zero (seen anywhere, including answer)  ***R1***

*e.g*.  , 

correct working (accept equality) ***A1***

*e.g*.  ,  , 

both correct values (even if inequality never seen) ***(A1)***

*e.g*.  , 

correct interval ***A1******N3***

*e.g*.  , 

**Note:** Do not award the final mark for unfinished values, or for incorrect or reversed inequalities, including  ,  ,  .

**Special cases:**

If working shown, and candidates attempt to rearrange the quadratic equation to equal zero, but find an incorrect value of *c*, award ***A1M1R1A0A0A0***.

If working shown, and candidates do not rearrange the quadratic equation to equal zero, but find  or  , award ***A0M1R1A0A0A0***.

***[6 marks]***

**9a.** *[6 marks]*

(a) Write down the -intercepts of the graph of  .

(b) Find the coordinates of the vertex of the graph of  .

## Markscheme

(a)  ,  (accept (, ), (, ) ) ***A1A1 N2***

***[2 marks]***

(b) **METHOD 1**

attempt to find -coordinate ***(M1)***

*eg*  ,  , 

correct value,  (may be seen as a coordinate in the answer) ***A1***

attempt to find **their** -coordinate ***(M1)***

*eg*  ,  , 

***A1***

vertex (, ) ***N3***

**METHOD 2**

attempt to complete the square ***(M1)***

*eg* 

attempt to put into vertex form ***(M1)***

*eg*  , 

vertex (, ) ***A1A1 N3***

***[4 marks]***

**9b.** *[2 marks]*

Write down the -intercepts of the graph of  .

## Markscheme

 ,  (accept (, ), (, ) ) ***A1A1 N2***

***[2 marks]***

**9c.** *[4 marks]*

Find the coordinates of the vertex of the graph of  .

## Markscheme

**METHOD 1**

attempt to find -coordinate ***(M1)***

*eg*  ,  , 

correct value,  (may be seen as a coordinate in the answer) ***A1***

attempt to find **their** -coordinate ***(M1)***

*eg*  ,  , 

***A1***

vertex (, ) ***N3***

**METHOD 2**

attempt to complete the square ***(M1)***

*eg* 

attempt to put into vertex form ***(M1)***

*eg*  , 

vertex (, ) ***A1A1 N3***

***[4 marks]***

**10.** *[8 marks]*

The equation  has two distinct real roots.

Find the possible values of .

## Markscheme

evidence of discriminant ***(M1)***

*eg* 

correct substitution into discriminant ***(A1)***

*eg* 

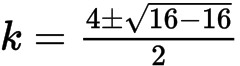
correct discriminant ***A1***

*eg* 

recognizing discriminant is positive ***R1***

*eg* 

attempt to solve **their** quadratic in ***(M1)***

*eg* factorizing, 

correct working ***A1***

*eg* , sketch of positive parabola on the *x*-axis

correct values ***A2 N4***

*eg* 

***[8 marks]***

**11a.** *[4 marks]*

(i) Write down the coordinates of the vertex.

(ii) Hence or otherwise, express the function in the form  .

## Markscheme

(i)  or  , ***A1A1 N2***

(ii) evidence of valid approach ***(M1)***

e.g. graph, completing the square, equating coefficients

***A1 N2***

***[4 marks]***

**11b.** *[3 marks]*

Solve the equation  .

## Markscheme

evidence of valid approach ***(M1)***

e.g. graph, quadratic formula

 , 

 , ***A1A1 N3***

***[3 marks]***

**12a.** *[2 marks]*

Write down the value of *q* and of *r*.

## Markscheme

 ,  or  , ***A1A1 N2***

***[2 marks]***

**12b.** *[1 mark]*

Write down the **equation** of the axis of symmetry.

## Markscheme

 (must be an equation) ***A1 N1***

***[1 mark]***

**12c.** *[3 marks]*

Find the value of *p*.

## Markscheme

substituting  into the equation ***(M1)***

e.g.  , 

correct working towards solution ***(A1)***

e.g. 

***A1 N2***

***[3 marks]***

**13a.** *[5 marks]*

Find the value of *k* .

## Markscheme

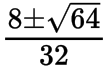
valid approach ***(M1)***

e.g.  ,  , 

correct equation ***A1***

e.g.  ,  , 

correct manipulation ***A1***

e.g.  , 

***A2 N3***

***[5 marks]***

**13b.** *[2 marks]*

The line  intersects the graph of *f* . Find all possible values of *p* .

## Markscheme

recognizing vertex is on the *x*-axis ***M1***

e.g. (1, 0) , sketch of parabola opening upward from the *x*-axis

***A1 N1***

***[2 marks]***

Printed for British School of Beijing

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