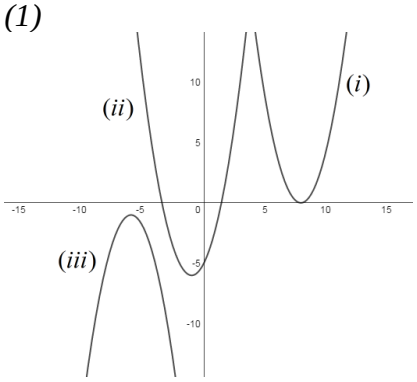
www.m4ths.com – AS Year 1
Discriminant

(1) State the conditions for the quadratic equation $ax^2+bx+c=0$ to have:
(i) 2 distinct real roots.
(ii) A repeated root (equal).
(iii) No real roots.

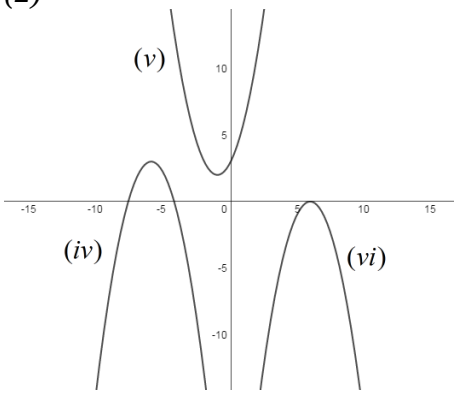
(2) Sketch a graph of the form $y=ax^2+bx+c$ given each of the following conditions:
(i) $b^2-4ac>0$ and $a>0$
(ii) $b^2-4ac>0$ and $a<0$
(iii) $b^2-4ac=0$ and $a>0$
(iv) $b^2-4ac=0$ and $a<0$
(v) $b^2-4ac<0$ and $a>0$
(vi) $b^2-4ac<0$ and $a<0$

(3) Calculate the discriminant for the each the questions below and state the number of real roots to each equation:
(a) $x^2-3x+5=0$
(b) $2x^2+3x-1=0$
(c) $-x^2+4x-5=0$
(d) $0.5x^2+2x-3=0$
(e) $5x^2+3x-2=6$
(f) $2(x-1)^2=x+4$
(g) $x(x-3)=1-x$
(h) $(x-5)^2=0$

(4) In diagrams *(1)* and *(2)* the graphs of 6 different quadratic equations in the form $y=ax^2+bx+c$ are shown.
(a) For each graph state whether b^2-4ac is $0, >0$ or <0.
(b) For each graph write down whether $a>0$ or $a<0$.
(1)



(2)



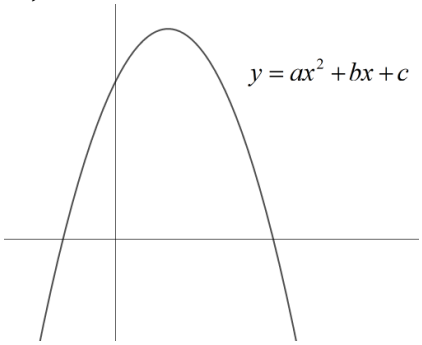
(5) The equation $kx^2-2kx+1=0$, $k>0$ where k is a constant has equal roots. Find the value of k.

(6) The equation $x^2-3px+1=0$ where p is a constant has no real roots. Find the possible values for the constant p.

(7) The equation $x^2+2qx+q=-12$ where q is a constant has two distinct real roots. Find the possible values of the constant q.

(8) Sketch a graph with equation $y=ax^2+bx+c$ where $a<0$ and $b^2-4ac>0$.
(You do not have to state any points of intersection with coordinate axis).

(9) The diagram below shows part of the curve $y=ax^2+bx+c$ where a, b and c are constants.



(a) State the range of values of the constant a.
(b) State the range of values of b^2-4ac.

(10) The line $y=mx-3$ is a tangent to the curve $y=x^2+3x+1$.
(a) Find the possible values of m.
(b) Given $m>0$ find the point where the tangent touches the curve.

(11) The line $y=c-2x$ where c is a constant is a tangent to the curve $y=\frac{2}{x}$, $x\neq 0$.
(a) Sketch the graph of $y=\frac{2}{x}$ stating the equations of any asymptotes.
(b) Find the possible values of the constant c.
(c) Given $c<0$ sketch the graph of $y=c-2x$ on a separate set of axis showing any points of intersection with the coordinate axis.

(12) $f(x)=-x^2+4x-7$
(a) Show the equation $-x^2+4x-7=0$ has no real roots.
(b) Sketch the graph of $y=f(x)$ stating the coordinates of the maximum point and the coordinates of the point where the curve cross the coordinate axis.
(c) Find the values of k such that $f(x)+k$ has 2 distinct real roots.

(13) Given the x axis is a tangent to the curve $y=2(x-3)^2+k$
(a) Write down the value of k.
(b) Sketch the curve showing any points where the curve touches or crosses the coordinate axis.
The discriminant of the equation $2(x-3)^2+p=0$ is 128.
(c) Find the value of p.