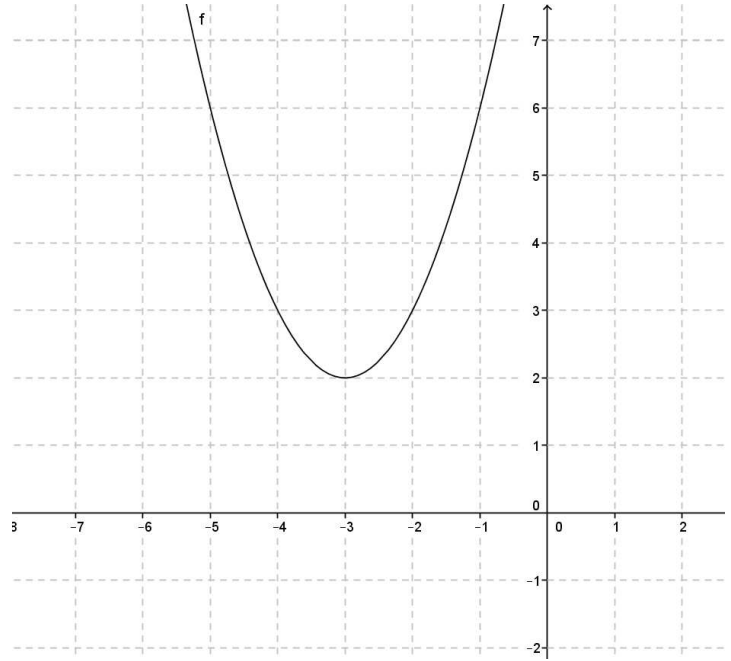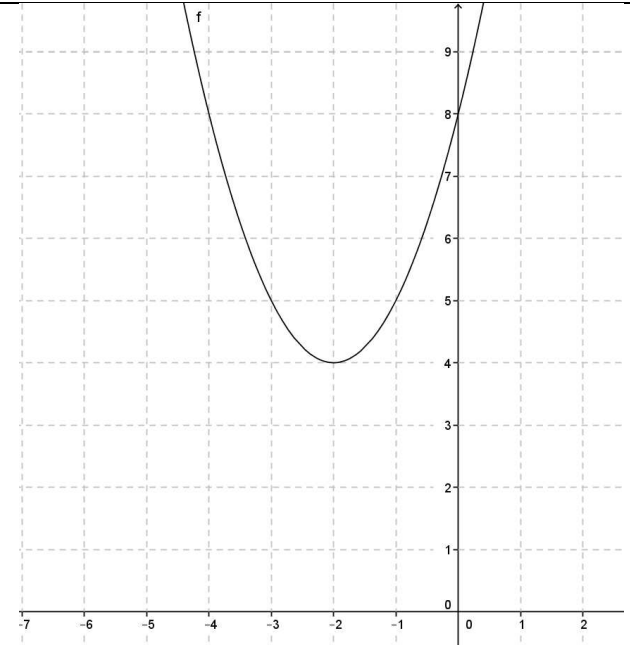# Turning points

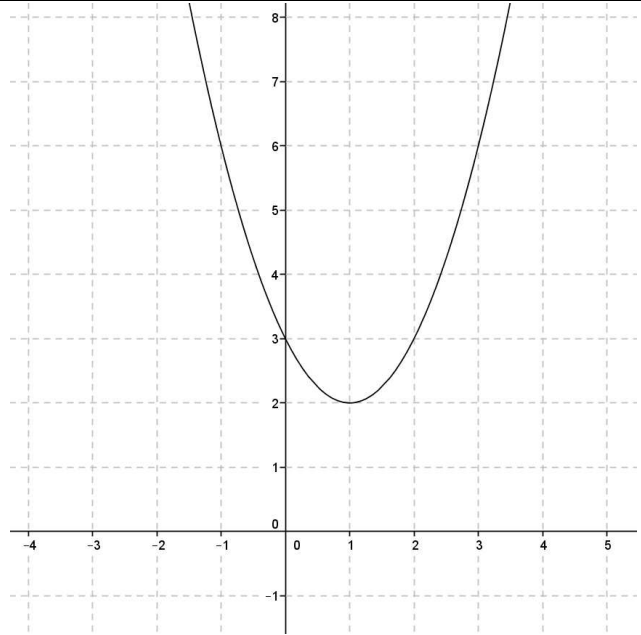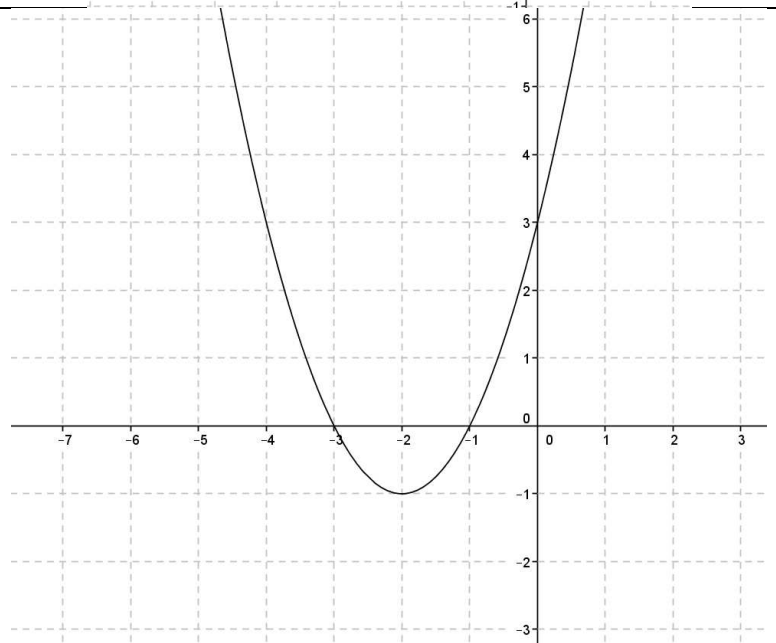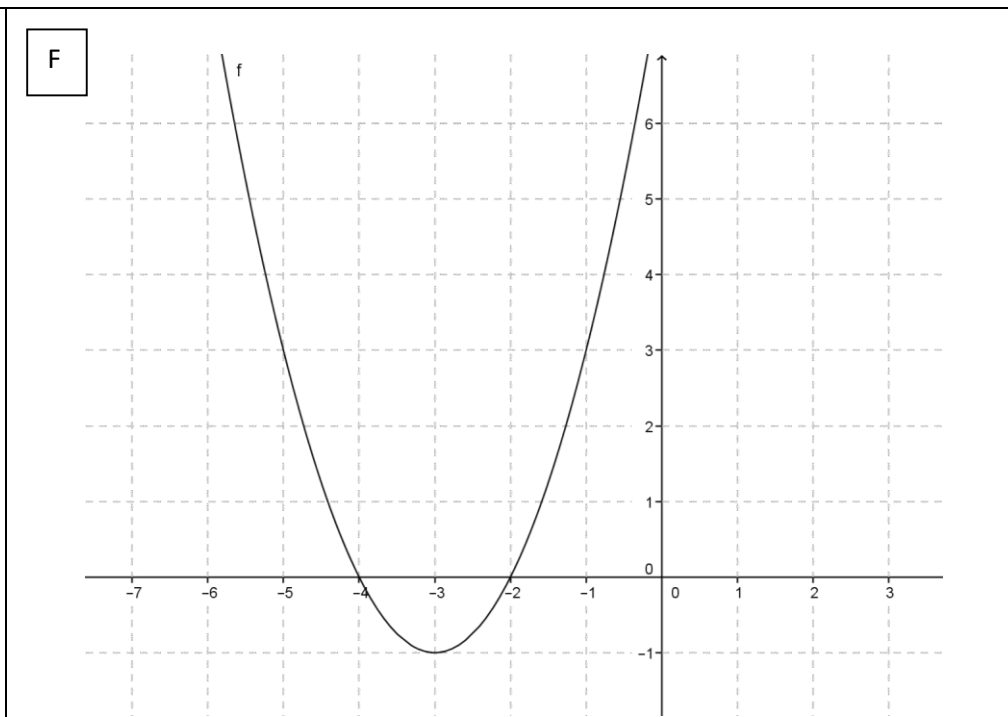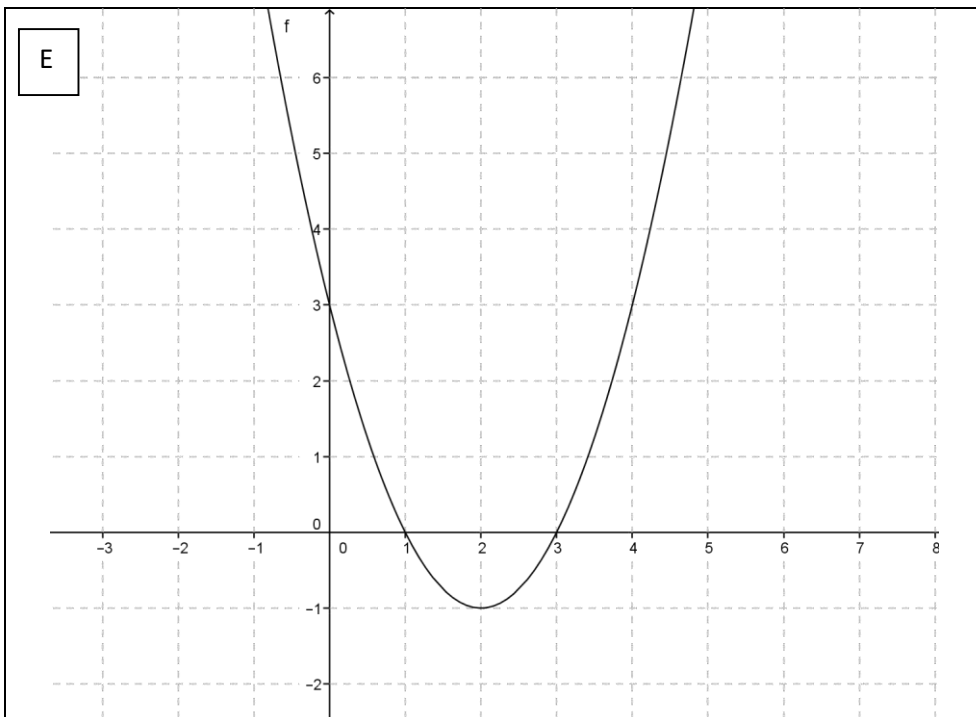| Turning Points	
Aim	This lesson uses technology in the form of graphing software to allow students to develop their understanding of the different forms of the equation of a quadratic and how this is represented in the graphical form. It is expected that students are familiar with Completing the Square and factorising before this lesson and it may be sensible to see the videos 'Working with Quadratics' and 'Completing the Square' before starting this lesson. *This video uses materials and ideas from the FMSP's E&E PD programme.*
Activity: demonstrating with graphing software	Showing $y = x_2$, ask students to sketch where $y = x^2 + 1$ might be. Practise with other lines of the form $y = x +/- a$. Again, starting with $y = x^2$ move the graph along the *x*-axis and show the completed square form of the equation of the line. Ask students spot the link between the equation and the turning point. Hiding the equation of the line, move the graph along the *x*-axis and ask the students to give the equation of the line in completed square form. Once students are confident in these two aspects, combine them by moving the turning point away from the axes and asking students to reason the equation of the line. Use all four quadrants to bring out any misconceptions and develop understanding.
Activity: matching graphs and equations	Students are given sets of cards which contain many blanks. They should match together the graph, the coordinate of the turning point, the equation of the line in completed square form and the equation of the line in $y = ax^2 + bx + c$ form. There are many blank card to allow students to complete each set. If necessary, students could be directed to match two forms together first (for example, the graphs and coordinates of the turning points) before moving onto the other cards. It is suggested that blank cards are printed on an alternative colour to allow for easy sorting and reusing of the cards in this activity.
The resources used in the video follow.	

A

B

C

D

E

F

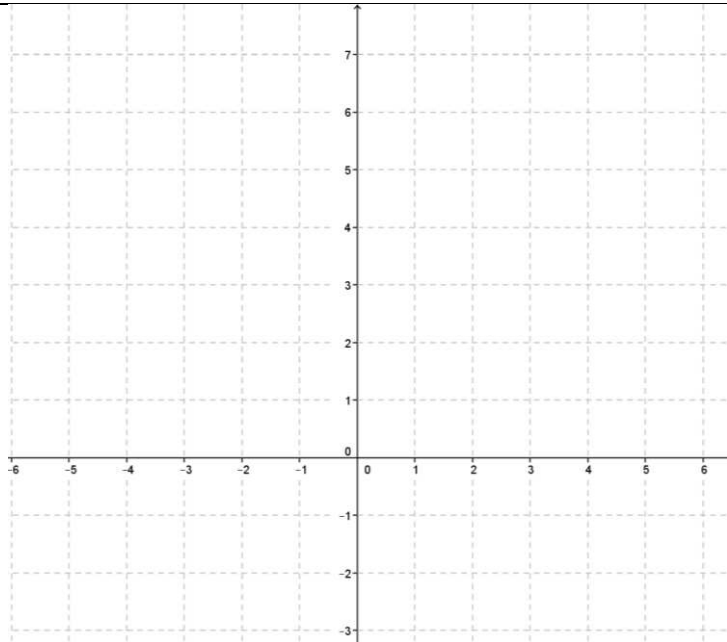|		
1 $f(x) = x^2 + 6x + 11$	**2** $(1,\text{-}2)$	**3** $f(x) = (x+2)^2 + 4$
4 $f(x) = (x+2)^2 + 1$	**5** $(\text{-}2,\text{-}1)$	**6** $f(x) = (x-2)^2 - 1$
7 $f(x) = x^2 - 2x + 3$	**8** $(1,2)$	**9** $f(x) = x^2 - 2x - 1$

Instructions: for each function there should be a graphical representation, a completed square form, an expanded expression and a turning point. Match the cards and fill the blank cards to complete the sets.

G

H