Craigieburn Secondary College

Best Practice #2

AusVELS 10.0- Students are able to solve simple quadratic equations using a range of strategies.

	Task: In an experiment, the temperature in a chamber is designed to change with time according to the formula: $p = 3t^2 - 18t + 5$ Where *p* is the temperature in °C after a given time, *t*, measured in hours. a. What is the initial temperature in the chamber (i.e. when *t* = 0)? b. What is the temperature after 2 hours? c. At what times does the temperature reach zero? d. What is the minimum temperature reached in the chamber? At what time is this reached? e. The experiment is terminated when the temperature reaches 45°. For how long does the experiment run?	
Step 1:	**a) Let t=0** **As t, stands for time. Substituting t=0 will give us the temperature in the chamber after 0 hours as elapsed.** **Substitute t=0 into the formula**	$P = 3t^2 - 18t + 5$ When $t = 0$, $P = 3 \times 0^2 - 18 \times 0 + 5$ $= 5$ The temperature was initially 5°C in the chamber. Whenever you see t, substitute the letter t, for the number 0
Step 2:	**b) Let t=2** **As t, stands for time. Substituting t=2 will give us the temperature in the chamber after 2 hours.** **Substitute t=2 into the formula**	$p = 3t^2 - 18t + 5$ When $t = 2$, $p = 3 \times 2^2 - 18 \times 2 + 5$ $= -19$ After 2 hours, the temperature was –19°C. Whenever you see t, substitute the letter t, for the number 2.
Step 3:	c) **Use the quadratic formula.** For any parabola $y = ax^2 + bx + c$, the *x*-intercepts are: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	When $p = 0$, $0 = 3t^2 - 18t + 5$ Substitute $a = 3$, $b = -18$, $c = 5$ into the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{18 \pm \sqrt{18^2 - 4 \times 3 \times 5}}{2 \times 3}$ $x = \frac{18 \pm \sqrt{264}}{6}$

		$x = \frac{18+\sqrt{264}}{6}$ or 5.71 And $x = \frac{18-\sqrt{264}}{6}$ or 0.29 Convert your answer into hours and minutes 5.70 **hours** 0.70 x 60= 42minutes **5.71 = 5hours and 42 minutes** **0.29** **0 hours** 0.29 x 60= minutes 17minutes **The temperature is zero after 0.29 hours and again after 5.71 hours or 17 minutes and 5 h 42 minutes, respectively**
Step 4:	*d)* $p = 3t2 - 18t + 5$ Since the coefficient of t^2 is positive, the vertex of the parabola will be a ***minimum turning point***. Minimum is reached when: $t = \frac{-b}{2a}$	$t = \frac{-b}{2a}$ $a = 3$, $b = -18$, $t = \frac{18}{2x3}$ T=3 When t=3 (substitute t=3 into equation) $p = 3t^2 - 18t + 5$ $p = 3 \text{ x } 3^2 - 18x3 + 5$ p= - 22 The minimum temperature is –22°C after 3 hours
Step 5:	*e)* When $p = 45$, $45 = 3t^2 - 18t + 5$	~~45~~ = $3t^2 - 18t + 5$ ~~-45~~ -45 $0 = 3t_2 - 18t - 40$

Step 6:		$$t=\frac{-18\pm\sqrt{-18^2-4\times 3\times -40}}{2\times 3}$$ $$t=\frac{-18\pm\sqrt{804}}{6}$$ In this experiment, time is only for positive values. So the experiment is terminated after 7.73 hours or 7 h 43 min