

# MATHEMATICS ANSWERS

## Level Three

### Least Squares

1.  $A = BMX + 5.10 + v_1$   
 $BMX = A + 2.34 + v_2$   
 $C = BMX - 1.25 + v_3$   
 $BMX = C - 6.13 + v_4$   
 $B = A - 0.68 + v_5$   
 $B = BMX - 3.00 + v_6$   
 $C = B + 1.70 + v_7$

2.  $v_1^2 = (A - 105.10)^2$        $v_2^2 = (105.16 - A)^2$   
 $v_3^2 = (C - 106.25)^2$        $v_4^2 = (106.13 - C)^2$   
 $v_5^2 = (B - A + 0.68)^2$        $v_6^2 = (B - 104.50)^2$   
 $v_7^2 = (C - B - 1.70)^2$

3.  $F(v) = (A - 105.10)^2 + (105.16 - A)^2 + (C - 106.25)^2 + (106.13 - C)^2 +$   
 $(B - A + 0.68)^2 + (B - 104.50)^2 + (C - B - 1.70)^2 = \text{minium}$

4.  $\frac{\partial F}{\partial A} = 2(A - 105.10) - 2(105.16 - A) - 2(B - A + 0.68) = 0$

$$\frac{\partial F}{\partial B} = 2(B - A + 0.68) + 2(B - 104.50) - 2(C - B - 1.70) = 0$$

$$\frac{\partial F}{\partial C} = 2(C - 106.25) - 2(106.13 - C) + 2(C - B - 1.70) = 0$$

5.  $3A - B = 210.94$   
 $-A + 3B - C = 102.12$   
 $-B + 3C = 214.08$

6.  $A = 105.14$   
 $B = 104.48$   
 $C = 106.19$