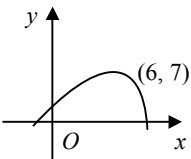
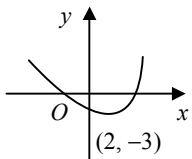
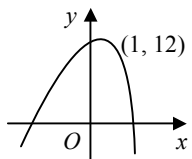
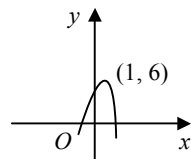
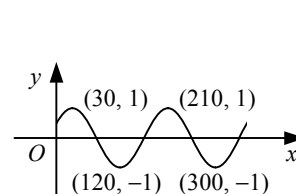
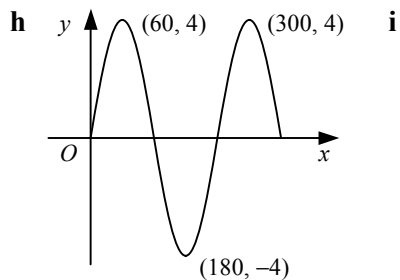
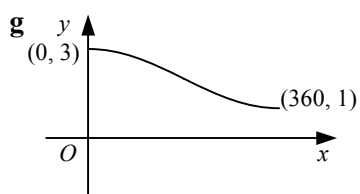
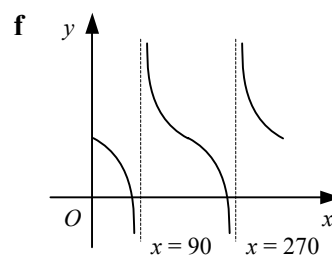
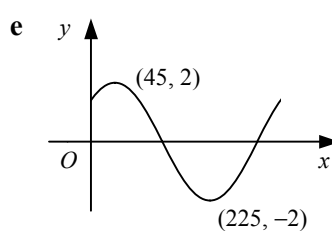
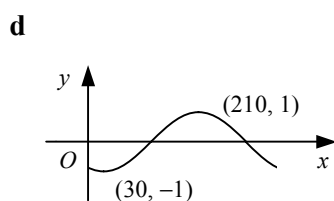
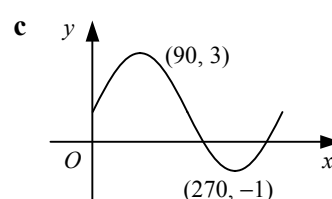
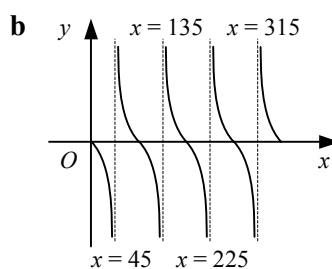
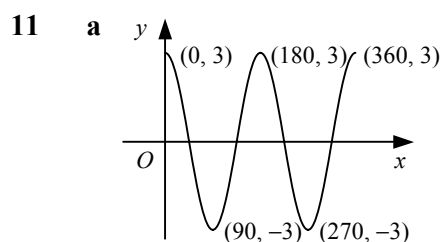
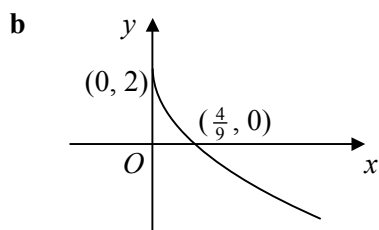


**Note: For this worksheet especially, there may be alternative correct answers**

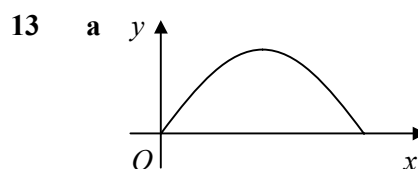
- 1 a translated 3 units in negative  $x$ -direction and translated 2 units in positive  $y$ -direction  
 b translated 1 unit in positive  $x$ -direction and stretched by a factor of 3 in  $y$ -direction  
 c reflected in the  $x$ -axis and then translated 4 units in positive  $y$ -direction  
 d translated 6 units in negative  $x$ -direction and then stretched by a factor of  $\frac{1}{2}$  in  $x$ -direction
- 2 a  $= (x + 3)^2 - 9 + 2 = (x + 3)^2 - 7$   
 b translation by 3 units in negative  $x$ -direction and translation by 7 units in negative  $y$ -direction
- 3 a  $y = 2[2(x - 3) + 7] \Rightarrow y = 4x + 2$   
 b  $y = 2[3e^{(x-3)}] \Rightarrow y = 6e^{x-3}$   
 c  $y = 2[(x - 3)^2 - 3(x - 3) + 1] \Rightarrow y = 2x^2 - 18x + 38$   
 d  $y = 2\left[\frac{1}{(x-3)}\right] \Rightarrow y = \frac{2}{x-3}$
- 4 a stretch by a factor of 3 in  $y$ -direction, then translation by 2 units in positive  $y$ -direction  
 b reflection in the  $y$ -axis and translation by 5 units in positive  $y$ -direction (either first)  
 c translation by 4 units in negative  $x$ -direction and stretch by a factor of 3 in  $y$ -direction (either first)  
 d translation by 1 unit in positive  $x$ -direction, then stretch by a factor of  $\frac{1}{2}$  in  $x$ -direction
- 5 a  b  c  d 
- 6 first  $\Rightarrow y = (x + 2)^2 + 4(x + 2) - 2 \Rightarrow y = x^2 + 8x + 10$   
 second  $\Rightarrow y = 3[x^2 + 8x + 10] \Rightarrow y = 3x^2 + 24x + 30$   
 third  $\Rightarrow y = 3(-x)^2 + 24(-x) + 30 \Rightarrow y = 3x^2 - 24x + 30$
- 7 a  $= 2[x^2 - 2x] + 7 = 2[(x - 1)^2 - 1] + 7 = 2(x - 1)^2 + 5$   
 b translation by 5 units in negative  $y$ -direction,  
 then stretch by a factor of  $\frac{1}{2}$  in  $y$ -direction,  
 then translation by 1 unit in negative  $x$ -direction
- 8 a  $f'(x) = 3x^2 - 6x$   
 SP:  $3x^2 - 6x = 0$   
 $3x(x - 2) = 0$   
 $x = 0, 2$   
 $\therefore (0, 4)$  and  $(2, 0)$   
 b i  $(0, -8)$  and  $(2, 0)$     ii  $(0, 7)$  and  $(4, 3)$     iii  $(2, 4)$  and  $(0, 0)$

- 9 a stretch by factor of 3 in  $y$ -direction,  
then reflection in  $x$ -axis,  
then translation by 2 units in +ve  $y$ -dir'n
- 10 a  $180^\circ$   
b  $(0, 1)$   
c  $(90, 3)$  and  $(270, 3)$



- 12 a  $60^\circ$   
b  $\frac{360^\circ}{k}$

- 14 a max. value 4  $\therefore a = 4$   
max. occurs at  $x = 45 \therefore b = 2$   
b  $(135, -4)$



- b  $(\pi, 2)$   
c  $2 \sin \frac{1}{2}x = \sqrt{2}$   
 $\sin \frac{1}{2}x = \frac{1}{\sqrt{2}}$   
 $\frac{1}{2}x = \frac{\pi}{4}, \pi - \frac{\pi}{4}$   
 $= \frac{\pi}{4}, \frac{3\pi}{4}$   
 $x = \frac{\pi}{2}, \frac{3\pi}{2}$