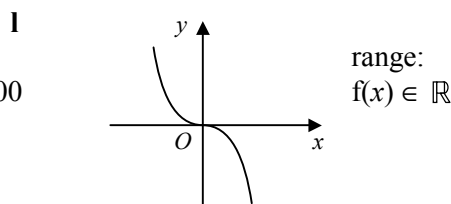
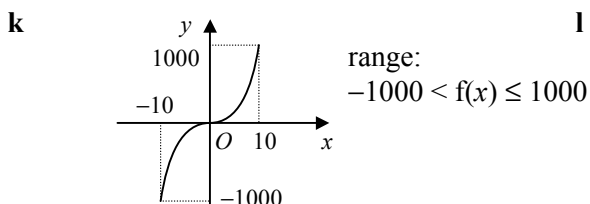
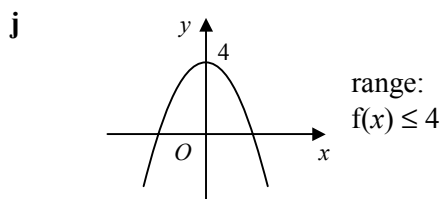
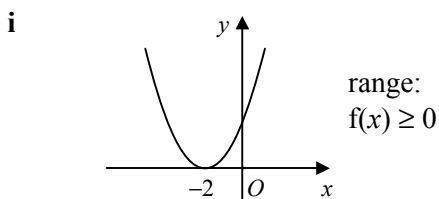
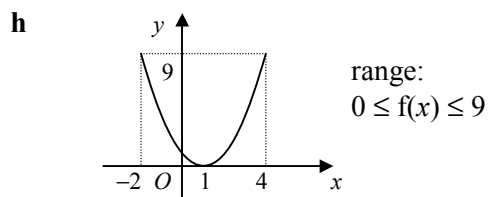
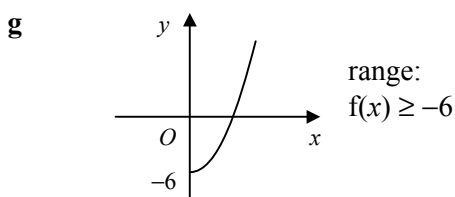
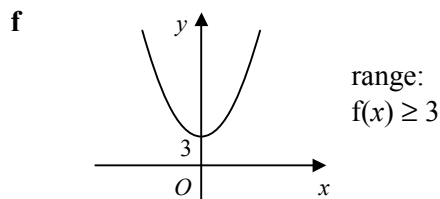
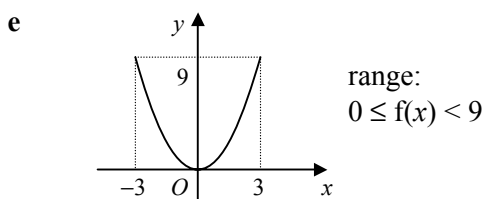
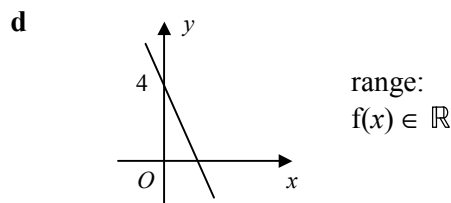
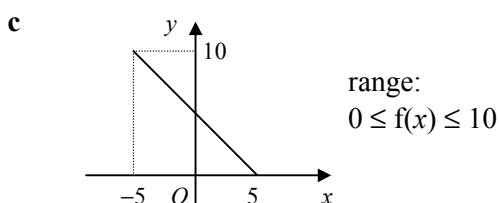
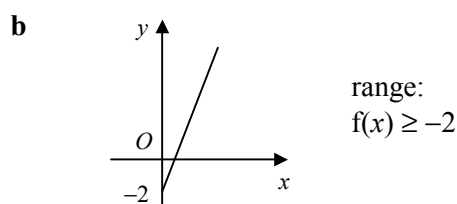
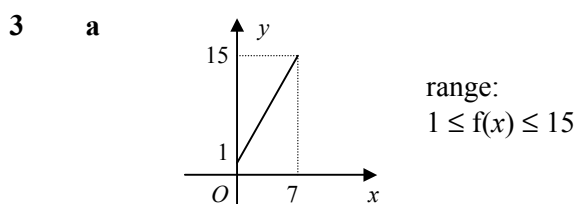
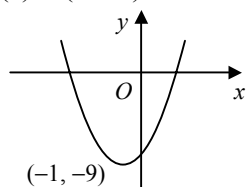


1 a 4 b 2 c 11 d -2 e -4 f -2
 g $\frac{2}{5}$ h -3 i $\frac{5}{4}$ j -8 k -4 l $\frac{12}{13}$

2 a $= \sin \pi$ b $= \ln 2$ c $= 5$ d $= \sin \frac{2\pi}{3}$ e $= 3 + 2e^{-1}$ f $= \ln \frac{9}{2}$
 $= 0$ $= 0.693$ $= \frac{\sqrt{3}}{2}$ or 0.866 $= 3.74$ $= 1.50$
 g $= 3 + 2e^{1.8}$ h $= \ln 1$ i $= \sin(0.6 + \frac{\pi}{3})$ j $= 3 + 2e^{\frac{1}{3}}$ k $= \sin(\frac{\pi}{3} - 2)$ l $= \ln \frac{23}{4}$
 $= 15.1$ $= 0$ $= 0.997$ $= 5.79$ $= -0.815$ $= 1.75$

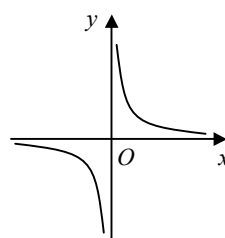


4 a $f(x) = (x+1)^2 - 9 \therefore (-1, -9)$



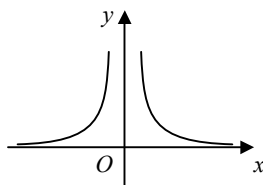
range:
 $f(x) \geq -9$

b



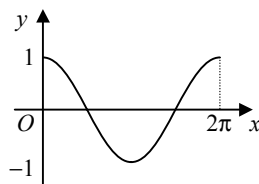
range:
 $f(x) \in \mathbb{R}, f(x) \neq 0$

c



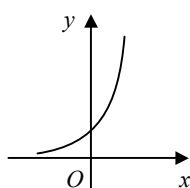
range:
 $f(x) > 0$

d



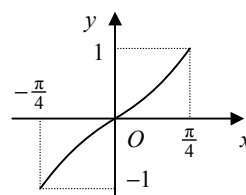
range:
 $-1 \leq f(x) \leq 1$

e



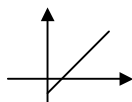
range:
 $f(x) > 0$

f



range:
 $-1 \leq f(x) \leq 1$

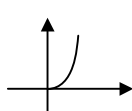
5 a $f(0) = -1, f(7) = 6$
 $\therefore 0 \leq x < 7$



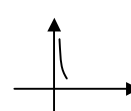
b $f(0) = 4$
 $\therefore x \geq 0$



c $f(0) = 0, f(5) = 125$
 $\therefore 0 \leq x \leq 5$



d $f(\frac{1}{2}) = 2, f(\frac{1}{10}) = 10$
 $\therefore \frac{1}{10} < x < \frac{1}{2}$



6 a $4x + 3 = 9$
 $x = \frac{3}{2}$

b $x^2 - 7 = 18$
 $x^2 = 25$
 $x = \pm 5$

c $\frac{9}{x+2} = 6$
 $6x + 12 = 9$
 $x = -\frac{1}{2}$

d $4x + 3 = \frac{9}{x+2}$
 $(4x+3)(x+2) = 9$
 $4x^2 + 11x - 3 = 0$
 $(4x-1)(x+3) = 0$
 $x = -3, \frac{1}{4}$

e $x^2 - 7 - \frac{x+2}{9} = -\frac{19}{3}$
 $9x^2 - 63 - x - 2 = -57$
 $9x^2 - x - 8 = 0$
 $(9x+8)(x-1) = 0$
 $x = -\frac{8}{9}, 1$

f $4x + 3 + x^2 - 7 = 0$
 $x^2 + 4x - 4 = 0$
 $x = \frac{-4 \pm \sqrt{16+16}}{2}$
 $x = -2 \pm 2\sqrt{2}$
or -4.83, 0.828 (3sf)

7 a $f(x) = (x+2)^2 - 4 + 11 = (x+2)^2 + 7$ range: $f(x) \geq 7$

b $f(x) = (x-1)^2 - 1 - 6 = (x-1)^2 - 7$ range: $f(x) \geq -7$

c $f(x) = (2x+3)^2 - 9 + 3 = (2x+3)^2 - 6$ range: $f(x) \geq -6$

d $f(x) = (3x-1)^2 - 1 + 16 = (3x-1)^2 + 15$ range: $f(x) \geq 15$

e $f(x) = 15 - [x^2 + 4x] = 15 - [(x+2)^2 - 4] = 19 - (x+2)^2$ range: $f(x) \leq 19$