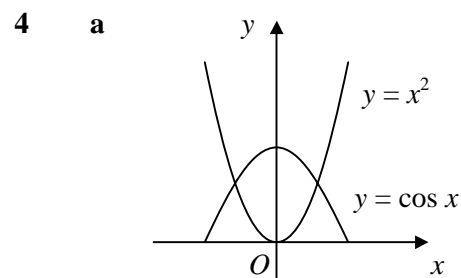


- 1 a let $f(x) = x^3 - 7x - 11$
 $f(3) = -5$
 $f(4) = 25$
 sign change, $f(x)$ continuous \therefore root
 b $x_1 = 3.230712$
 $x_2 = 3.225651$
 $x_3 = 3.226479 = 3.23$ (2dp)

- 3 a $f(0.4) = -0.809$
 $f(0.5) = 0.307$
 sign change, $f(x)$ continuous \therefore root
 $\therefore 0.4 < \alpha < 0.5$
 b $x_1 = 0.468857$
 $x_2 = 0.463841$
 $x_3 = 0.465157$
 $x_4 = 0.464810$
 $\therefore \alpha = 0.465$ (3dp)

- 5 a $f(1.4) = 3.65$
 $f(1.5) = -0.205$
 sign change, $f(x)$ continuous \therefore root
 b $e^{5-2x} - x^5 = 0 \Rightarrow x^5 = e^{5-2x}$
 $\Rightarrow x = (e^{5-2x})^{\frac{1}{5}}$
 $\Rightarrow x = e^{1-\frac{2}{5}x}, k = \frac{2}{5}$
 c $x_1 = 1.491825$
 $x_2 = 1.496711$
 $x_3 = 1.493789 = 1.494$ (3dp)

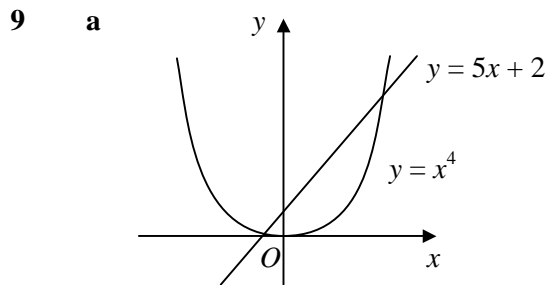
- 2 a $f(4) = -2.29$ (3sf)
 $f(5) = 0.829$ (3sf)
 b sign change, $f(x)$ continuous \therefore root
 c $4 \operatorname{cosec} x - 5 + 2x = 0$
 $2x = 5 - 4 \operatorname{cosec} x$
 $x = 2.5 - \frac{2}{\sin x}, a = 2.5, b = -2$
 d $x_1 = 4.545973$
 $x_2 = 4.528018$
 $x_3 = 4.534481 = 4.534$ (3dp)



- b $\cos x - x^2 = 0 \Rightarrow \cos x = x^2$
 the graphs $y = \cos x$ and $y = x^2$ intersect at 2 points, one for $x < 0$ and one for $x > 0$
 \therefore one negative and one positive real root
 c let $f(x) = \cos x - x^2$
 $f(0.8) = 0.0567$
 $f(0.9) = -0.188$
 sign change, $f(x)$ continuous \therefore root
 d $x_1 = 0.834690$
 $x_2 = 0.819395$
 $x_3 = 0.826235$
 $x_4 = 0.823195$
 $x_5 = 0.824550$
 \therefore root = 0.82 (2dp)

- 6 a $f(1.3) = -0.341$
 $f(1.4) = 0.383$
 sign change, $f(x)$ continuous \therefore root
 b $x_1 = 1.331571$
 $x_2 = 1.354168$
 $x_3 = 1.346907$
 $x_4 = 1.349261$
 c 1.35 (3sf)
 d diverges leading to \ln of a -ve which is not real

- 7 **a** $f'(x) = 6x^2 + 4$
b for all real x , $x^2 \geq 0$
 $\Rightarrow 6x^2 + 4 > 0$
 $\therefore f(x)$ increasing for all x
 $\therefore y = f(x)$ only crosses x -axis once
so exactly 1 real root
c $f(1.2) = -0.744$
 $f(1.3) = 0.594$
sign change, $f(x)$ continuous \therefore root
d $x_1 = 1.280579$
 $x_2 = 1.246945$
 $x_3 = 1.261203$
 $x_4 = 1.255199$
 \therefore root = 1.26 (2dp)
e $f(1.255) = -0.0267$
 $f(1.265) = 0.109$
sign change, $f(x)$ continuous \therefore root
- 8 **a** $3x + \ln x - x^2 = x \Rightarrow \ln x = x^2 - 2x$
 $\Rightarrow x = e^{x^2 - 2x}$
b let $f(x) = 2x + \ln x - x^2$
 $f(0.4) = -0.276$
 $f(0.5) = 0.0569$
sign change, $f(x)$ continuous \therefore root
c $f(2.3) = 0.143$
 $f(2.4) = -0.0845$
sign change, $f(x)$ continuous \therefore root
d $x_1 = 0.472367$
 $x_2 = 0.485973$
 $x_3 = 0.479134$
 $x_4 = 0.482537$
 \therefore x -coord of $A = 0.48$ (2dp)
e $f(0.475) = -0.0201$
 $f(0.485) = 0.0112$
sign change, $f(x)$ continuous \therefore root



- b** $x^4 - 5x - 2 = 0 \Rightarrow x^4 = 5x + 2$
the graphs $y = x^4$ and $y = 5x + 2$ intersect
at 2 points, one for $x < 0$ and one for $x > 0$
 \therefore one negative and one positive real root
c $x_1 = 1.821160$
 $x_2 = 1.825524$
 $x_3 = 1.826420$
 $x_4 = 1.826603 = 1.827$ (3dp)
d $x^4 - 5x - 2 = 0 \Rightarrow x^4 - 5x = 2$
 $\Rightarrow x(x^3 - 5) = 2$
 $\Rightarrow x = \frac{2}{x^3 - 5}$, $a = 2$, $b = -5$
e $x_1 = -0.394945$
 $x_2 = -0.395132$
 $x_3 = -0.395125$
 \therefore root = -0.3951 (4dp)