

### 3.3 Answers

**Additional Mathematics**  
**A-Level Pure Mathematics : Year 1**  
**Topics In Algebra**

#### 3.3.1 Solutions (3.1 Introductory Example)

$$\begin{aligned}x^2 - 6x &= 2 \\(x - 3)^2 - 9 &= 2 \\(x - 3)^2 &= 11 \\x - 3 &= \pm\sqrt{11} \\x &= 3 \pm \sqrt{11}\end{aligned}$$

[ 2 marks ]

#### 3.3.2 Solutions (3.2 Exercise)

##### Answer 1

|                           |                           |
|---------------------------|---------------------------|
| ( i ) $4 \pm \sqrt{17}$   | ( ii ) $-1 \pm \sqrt{6}$  |
| ( iii ) $6 \pm \sqrt{41}$ | ( iv ) $-7 \pm \sqrt{19}$ |

[ 8 marks ]

##### Answer 2

$$-3 \pm 2\sqrt{5}$$

[ 3 marks ]

##### Answer 3

|                            |                         |
|----------------------------|-------------------------|
| ( i ) $1 \pm \sqrt{17}$    | ( ii ) $2 \pm \sqrt{3}$ |
| ( iii ) $-2 \pm \sqrt{11}$ | ( iv ) $1 \pm \sqrt{3}$ |

[ 12 marks ]

##### Answer 4

$$1 \pm 3\sqrt{2}$$

##### Answer 5

$$10 \pm \sqrt{110}$$

[ 4, 4 marks ]

##### Answer 6

( a )      $a = -4, \quad b = -45$   
( b )      $x = 4 \pm 3\sqrt{5}, \quad c = 4, \quad d = 3$

[ 2, 3 marks ]

##### Answer 7

( a )      $a = -\frac{3}{2}, \quad b = -\frac{5}{4}$   
( b )      $x = \frac{3}{2} \pm \frac{\sqrt{5}}{2} \quad c = \frac{3}{2} \quad d = \frac{1}{2}$

[ 2, 3 marks ]

**Answer 8**

$$x = 1 \pm \sqrt{13}$$

**Answer 9**

$$x = \frac{3 \pm \sqrt{13}}{2} \quad a = 3, b = 13$$

[ 4, 3 marks ]

**Answer 10**

$$x = 3 \pm 2\sqrt{2}$$

[ 4 marks ]

**Answer 11**

( i )

$$\begin{aligned} [x^2 + 2px] + p &= 0 \\ [(x + p)^2 - p^2] + p &= 0 \\ (x + p)^2 &= p^2 - p \\ x + p &= \pm \sqrt{p^2 - p} \\ x &= -p \pm \sqrt{p^2 - p} \end{aligned}$$

[ 3 marks ]

( ii ) With  $p = 10$

$$\begin{aligned} x^2 + 20x + 10 &= 0 \\ x &= -10 \pm \sqrt{90} \\ &= -10 \pm 3\sqrt{10} \end{aligned}$$

[ 1 mark ]

( iii ) With  $p = 12$

$$\begin{aligned} x^2 + 24x + 12 &= 0 \\ x &= -12 \pm \sqrt{132} \\ &= -12 \pm 2\sqrt{33} \end{aligned}$$

[ 1 mark ]

( iv ) With  $p = 0.5$

$$\begin{aligned} x^2 + x + 0.5 &= 0 \\ x &= -0.5 \pm \sqrt{0.25 - 0.5} \\ &= -0.5 \pm \sqrt{-0.25} \end{aligned}$$

which has no solutions due to the negative square root

[ 2 marks ]

( v )

$$p^2 \geq p \quad \therefore p \leq -1 \text{ or } p \geq 1$$

[ 2 marks ]

**Answer 12****( i )**

$$\begin{aligned}
 [x^2 + 2px] + q &= 0 \\
 [(x + p)^2 - p^2] + q &= 0 \\
 (x + p)^2 &= p^2 - q \\
 x + p &= \pm \sqrt{p^2 - q} \\
 x &= -p \pm \sqrt{p^2 - q}
 \end{aligned}$$

**[ 3 marks ]****( ii )**

$$\begin{aligned}
 x^2 + 6x + 5 &= 0 \\
 x &= -3 \pm \sqrt{4} \\
 &= -1 \text{ or } -5
 \end{aligned}$$

**[ 1 mark ]****( iii )**

$$\begin{aligned}
 x^2 - 8x + 11 &= 0 \\
 x &= 4 \pm \sqrt{5}
 \end{aligned}$$

**[ 1 mark ]****( iv )**

$$\begin{aligned}
 x^2 + 6x + 10 &= 0 \\
 x &= -3 \pm \sqrt{9 - 10} \\
 &= -3 \pm \sqrt{-1}
 \end{aligned}$$

which has no solutions due to the negative square root

**[ 2 marks ]****( v )**

$$p^2 \geq q$$

**[ 2 marks ]**