# Section Check In – Core Pure: Algebra

## Questions

1. The roots of the equation  are  and . Find the value of .

2. The roots of the equation  are and . Find the equation whose roots are  and .

3. Write down a quadratic equation whose roots sum to 5 and have a product of 8.

4. Find the sum of the roots of the equation  .

5. The equation  has roots and.

(i) Show that the substitution  transforms the equation to

.

(ii) Deduce the value of

(a) ,

(b) .

6. The equation , where *k* is a real constant, has roots and. Find the value of .

7.\* The roots of the equation  are three consecutive terms of an arithmetic progression. Find the roots.

8. The equation , where *k* is a constant, has roots and. Find the value of  in terms of *k*.

9. (i) The equation  has roots  and . The equation is transformed   
 by the substitution .  
 List the roots of the new equation in terms of  and .

(ii) Analysis for a precision engineering company project requires the exact real root of the equation  to be found. Use the substitution  to find the exact value of  satisfying the equation.

10. , where *s* and *r* are real constants, has three equal roots. Find *s* and *r*.

**Extension**

1. The roots of the equation  are three consecutive terms of a

geometric progression. Find the roots.

2. The roots of the equation  are  and . Find the equation whose roots are

(i)  and ,

(ii)  and ,

(iii)  and .

## Worked solutions

1. From the equation,  and 

 or 

Alternative

Transform the equation using substitution , giving, after simplification, the equation



Required value is sum of roots of this equation, i.e. 

2. For new equation, roots are  so 





New equation is 

Alternatively, you could find  and 

3.  ; 

The equation is 

4. Sum of roots .

5. (i) Substituting  leads to 

Multiplying by  gives 

Expanding gives 

Simplifying gives 

(ii) Root of new equation corresponding to  is value of  where 

Rearranging gives  and so  or 

Roots of new equation are 

1. Sum of roots of new equation 

(b) Product of roots of new equation 

6. Sum of roots 









7. Let roots be  so that sum of roots 

From equation, sum of roots  so that  and 

Sum of roots two at a time 

From equation,  giving  and so 

Taking  gives roots  and therefore the roots are 

(Taking  gives same roots but in the reverse order)

Alternatives

After line 2 above, substituting  in the equation enables the value of  to be found  and then the equation can be solved by factorising the left-hand side (knowing already that one of the factors is ).

Calling the three roots  at the beginning leads to equivalent work but with slightly more involved algebra.

8.  is a root so 

Similarly 



Adding all three equations,







So 

9. (i) Root of new equation corresponding to  given by 

Rearranging,  and so roots of new equation are 

(ii) Applying substitution  gives 

Expanding and simplifying give  and 

So  and the exact  value required is 

10. Let the roots be α, α, α and β.

Sum of roots:   (1)

Taking sums of products of pairs of roots:  (2)

Sums of products of triples of roots:  (3)

Product of roots  (4)

Substitute (1) into (4) gives  so  and 

If  , then  and if  , then 

Either pair gives 

 or -8.

**Extension**

1. If roots are  their product is 

From equation, product is  giving  and so 

Considering sum of roots,  and solving this gives  or 

Using either value of , the three roots are 

2. From the equation,  and 

(i) Sum of roots 

Product of roots 

Equation is 

(ii) First, 

For new equation, sum of roots 

Product of roots 

Equation is 

(iii) Sum of roots 

Product of roots 

Equation is 

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