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**MATHEMATICS**

**SPECIALIST**

**UNIT 1**

**Semester One**

**2017**

**SOLUTIONS**

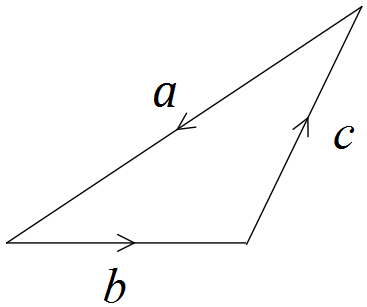
***Calculator−free Solutions***

1. (a)  ✓

 ✓

 ✓

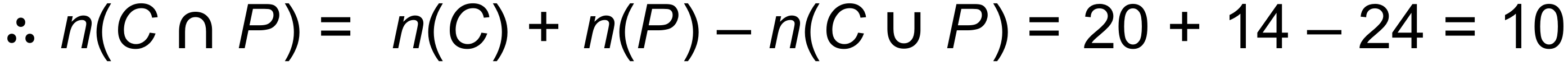
(b)  must form a closed loop, e.g.: ✓

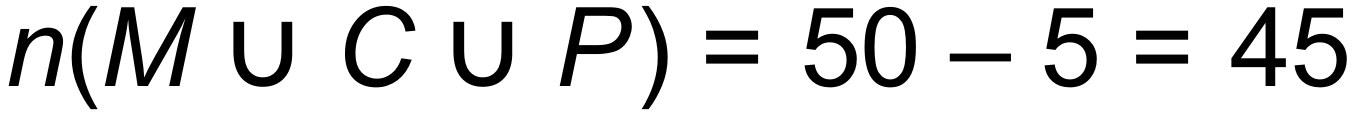


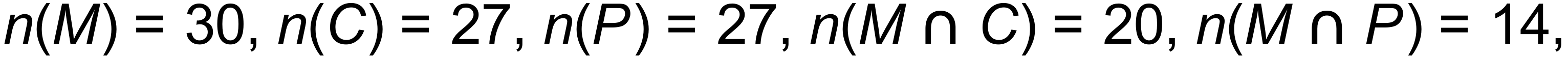
(c) III and IV ✓✓ [6]

2. (a)  ✓



 ✓✓

(b)  ✓



 ✓



 ✓

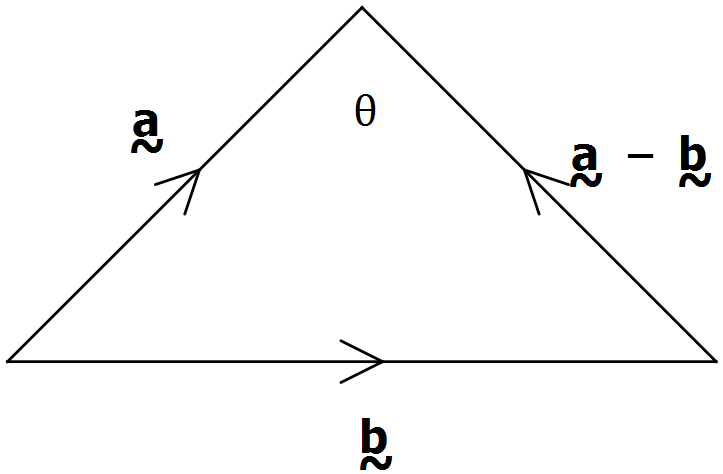
(c) 10 houses have married couples with children and pets,

therefore, 41 houses must be selected to obtain at least one

with both children and pets. ✓

The Pigeon Hole Principle. ✓ [8]

3. (a)

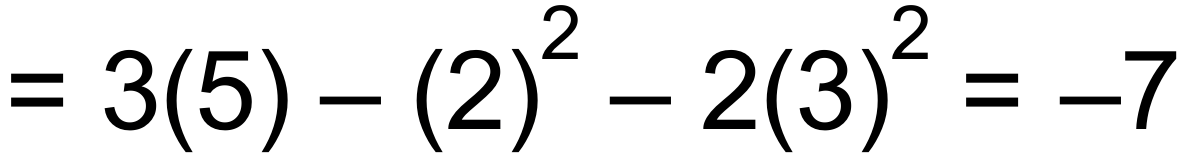


✓ vector 

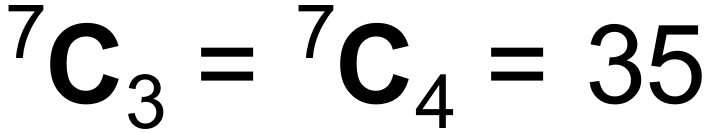
✓ location of 

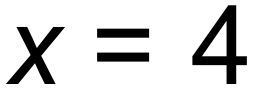
3. (b)  ✓

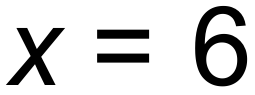
 ✓

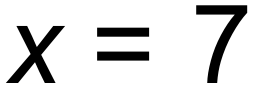
 ✓ [5]

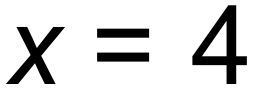
4. (a) (i) 20 ✓

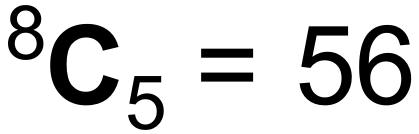
(ii)  ✓

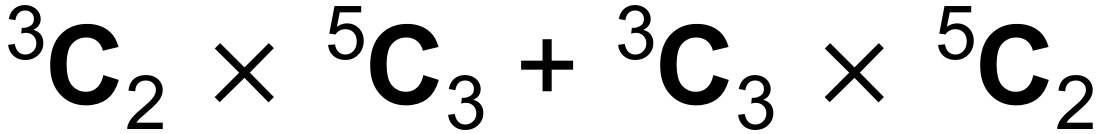
(b) (i) ; since 70 is in the 4th column of the 8th row ✓

(ii) ; since 15 is in the 4th column of the 6th row ✓

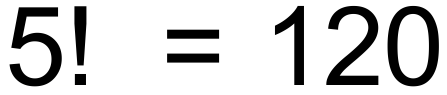
(iii) ; since in row 7, elements on columns 2 and 5 are equal ✓

(iv) ; since in row 8, elements on columns 2 and 6 are equal ✓

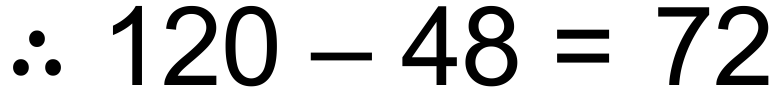
(c) (i)  ✓

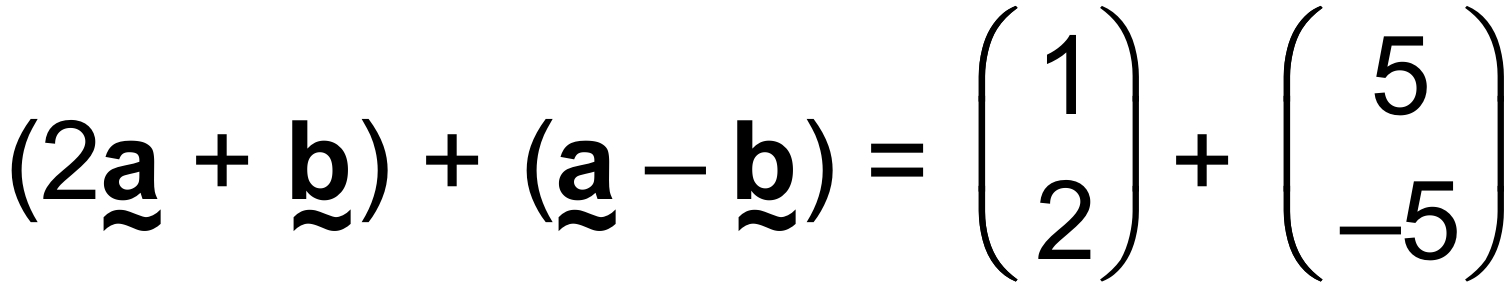
(ii)  ✓✓

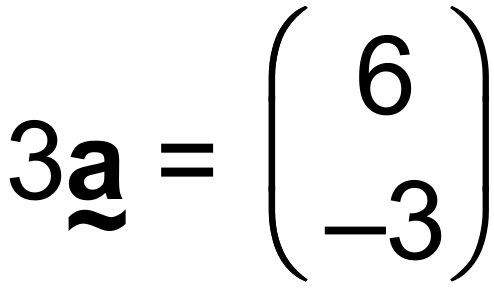
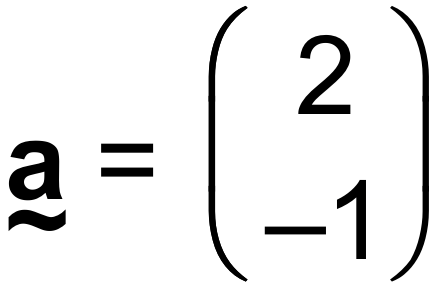
 ✓

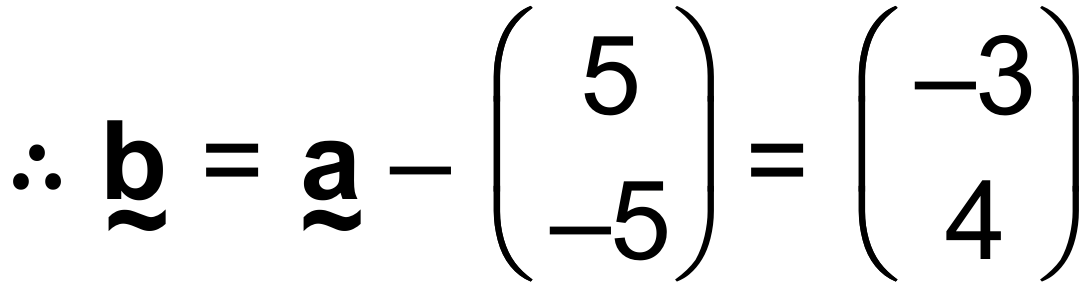
(d) (i)  ✓

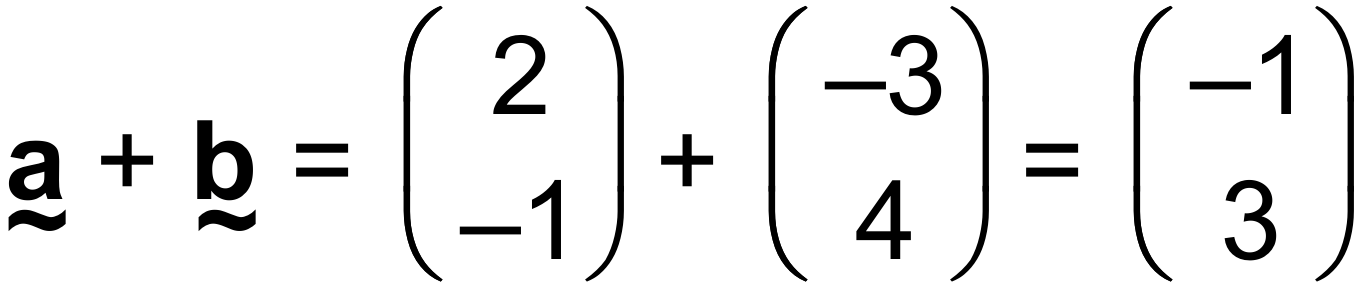
(ii)  ✓

 ✓ [13]

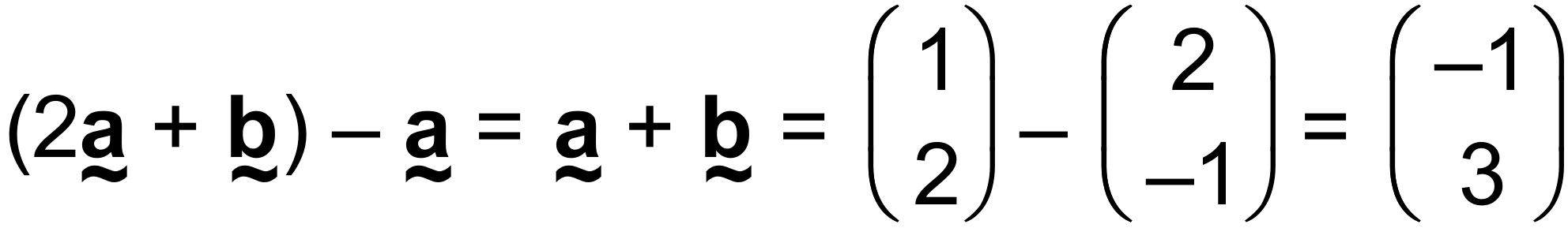
5. (a) 

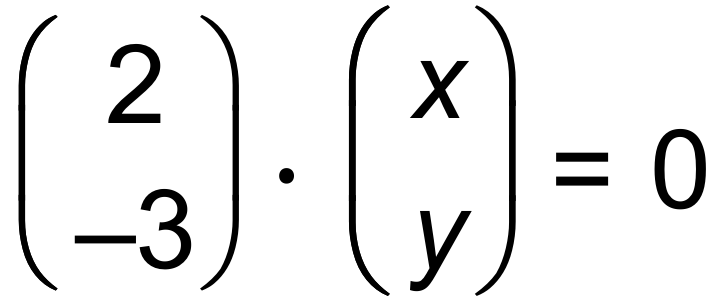
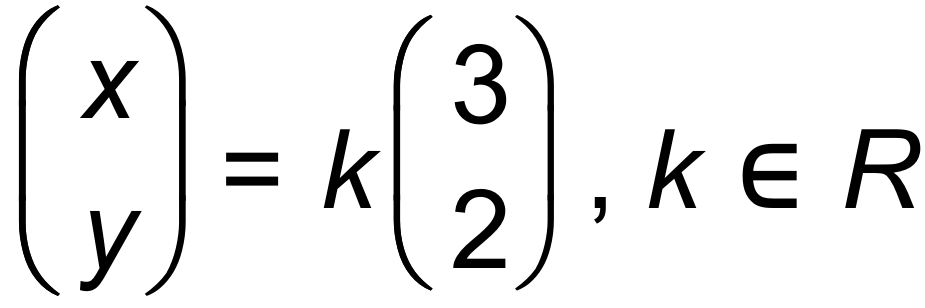
 , hence  ✓✓

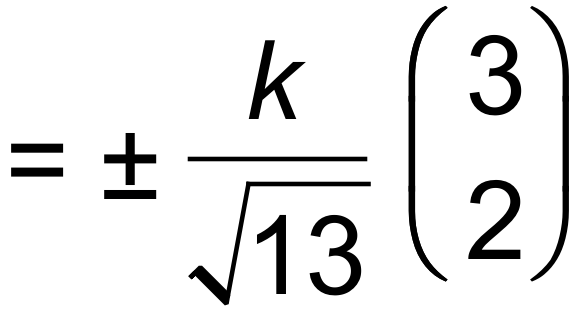
 ✓

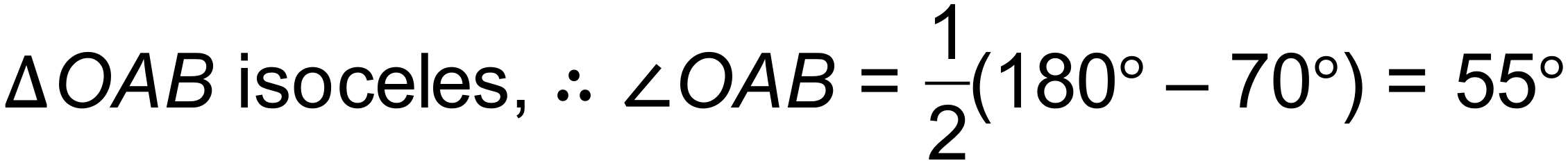
Hence,  ✓

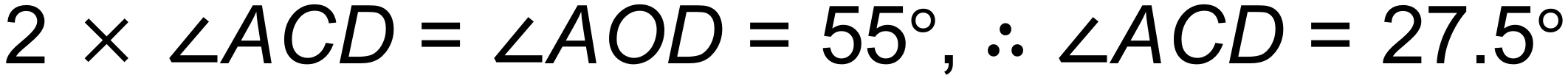
OR

 ✓✓

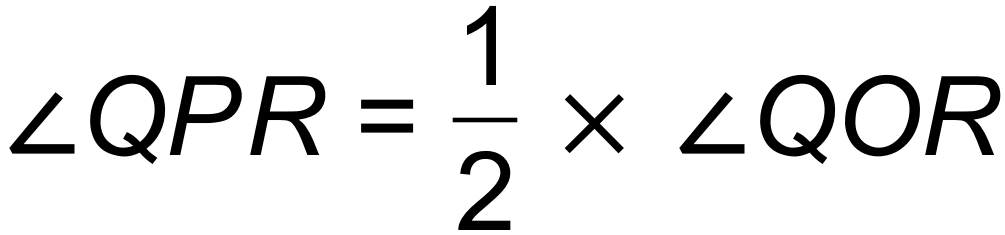
(b)  , hence  ✓

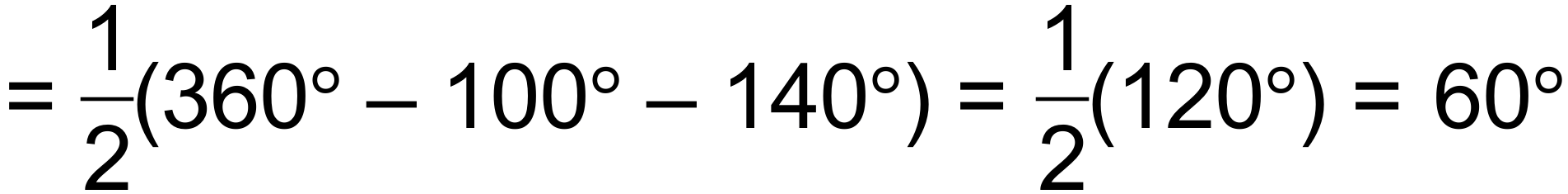
Unit vector  ✓ [6]

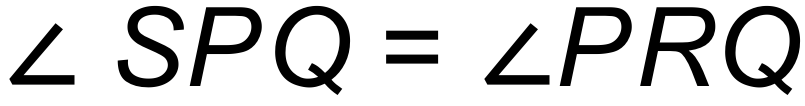
6. (a)  ✓

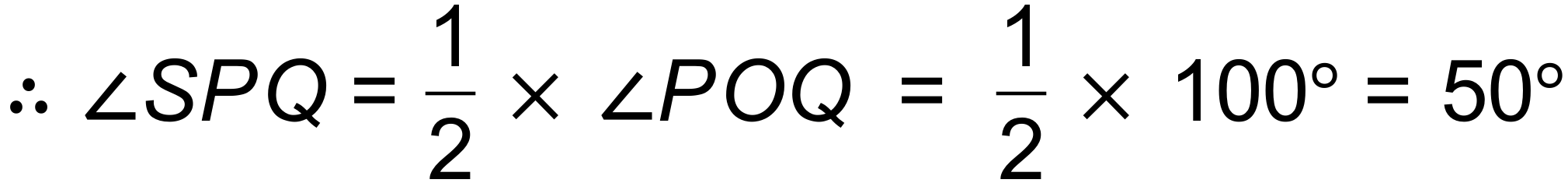
 ✓

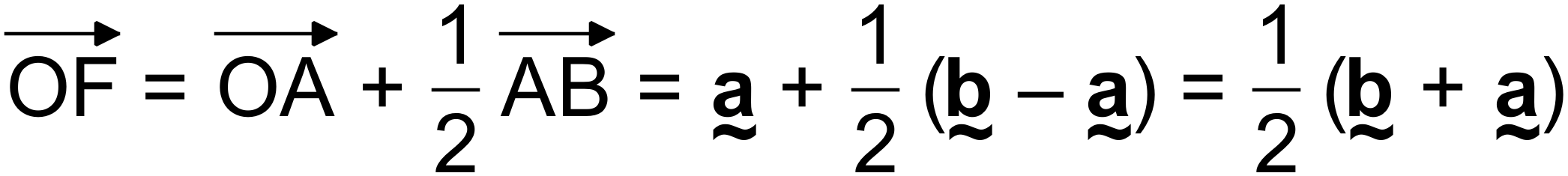
 ✓

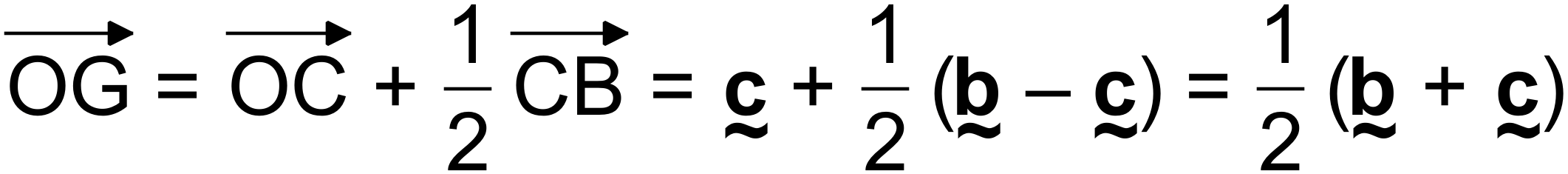
(b)  (angle at circumference is half angle at the centre) ✓

 ✓

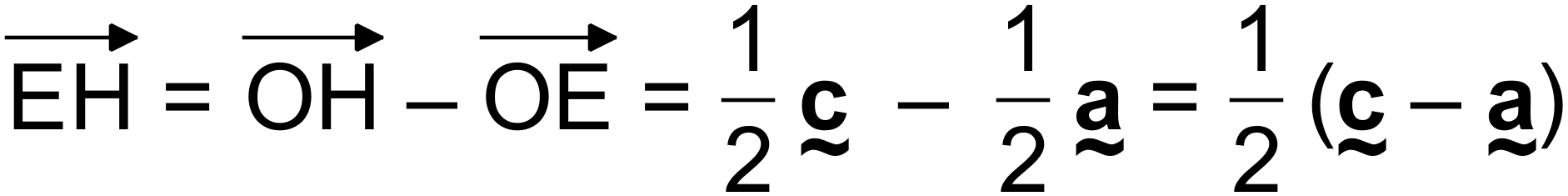
(c)  from the alternate-segment theorem ✓

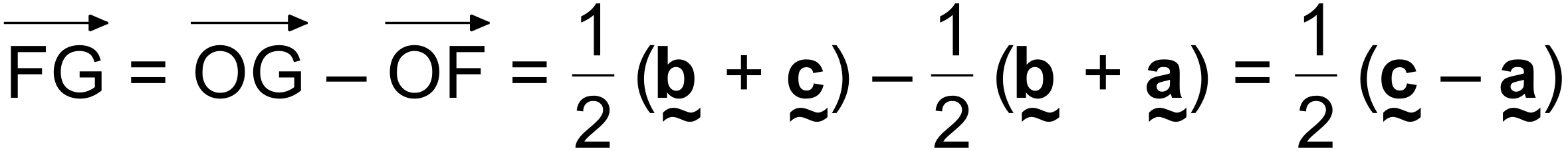
 ✓ [7]

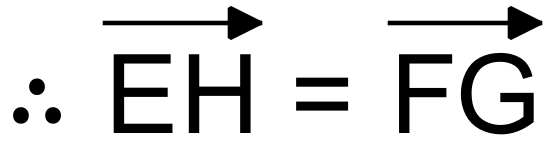
7. (a)  ✓

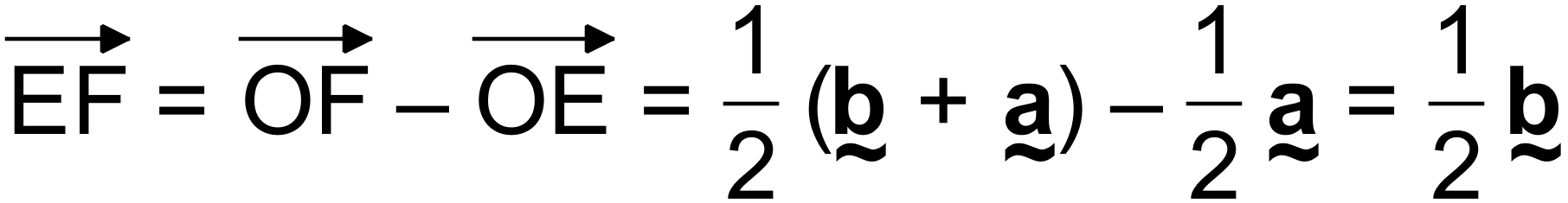
 ✓

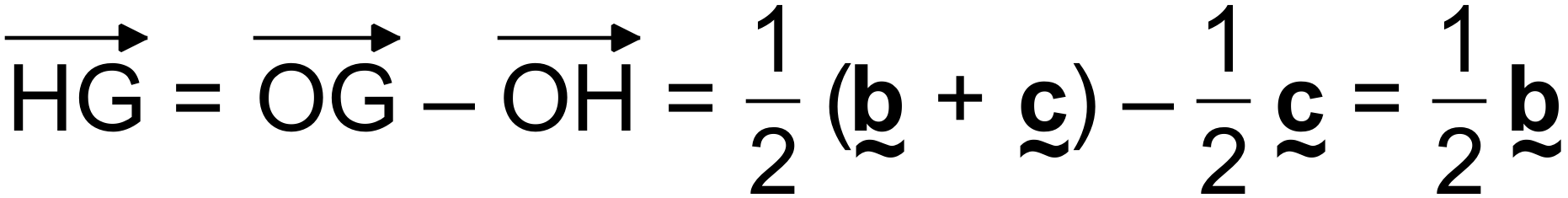
(b) Show that opposite sides are congruent and parallel:

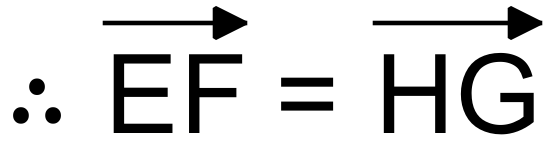
 ✓



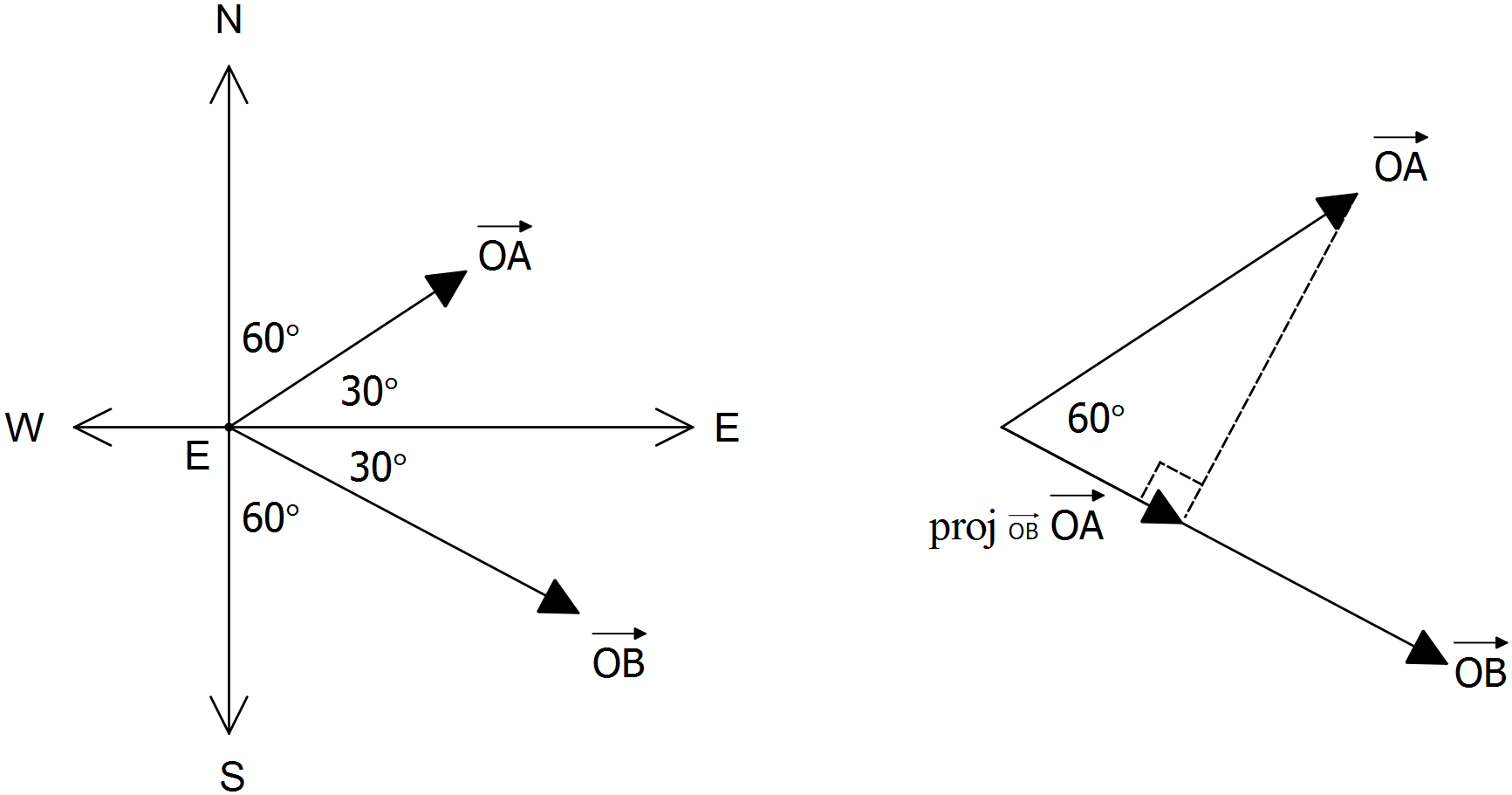
 as required. ✓



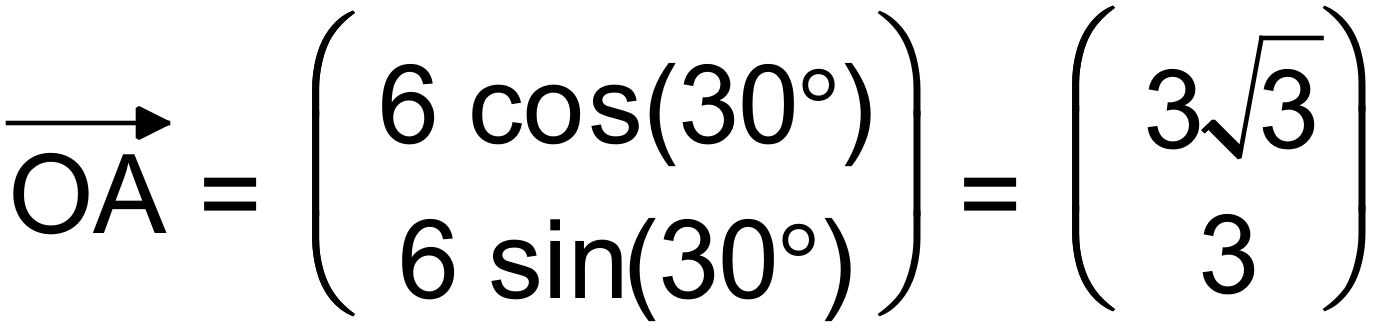


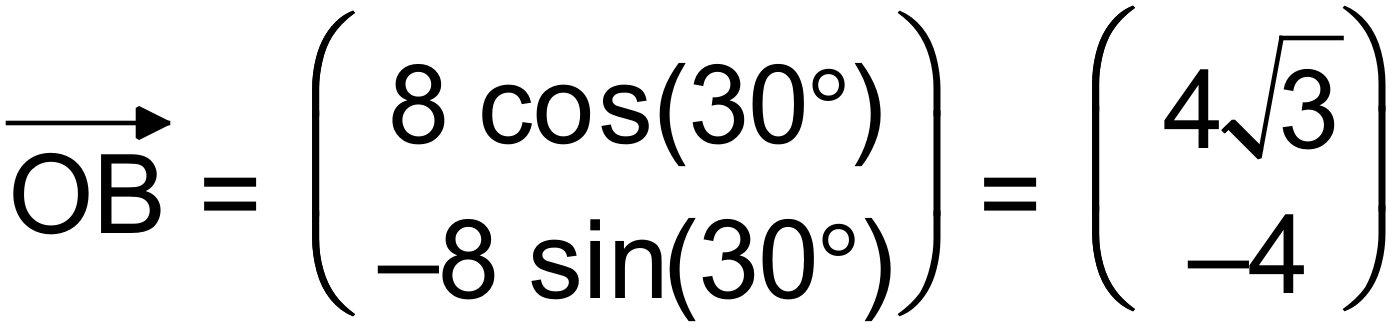
 , and EFGH is a parallelogram ✓ [5]

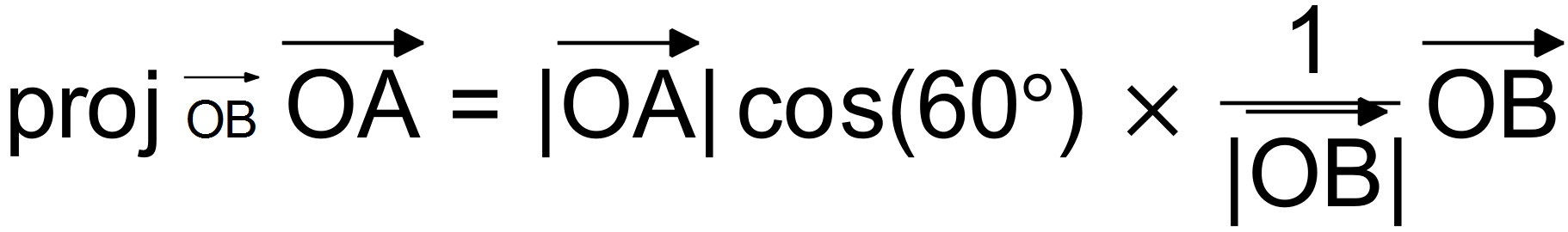
***Calculator−Assumed Solutions***

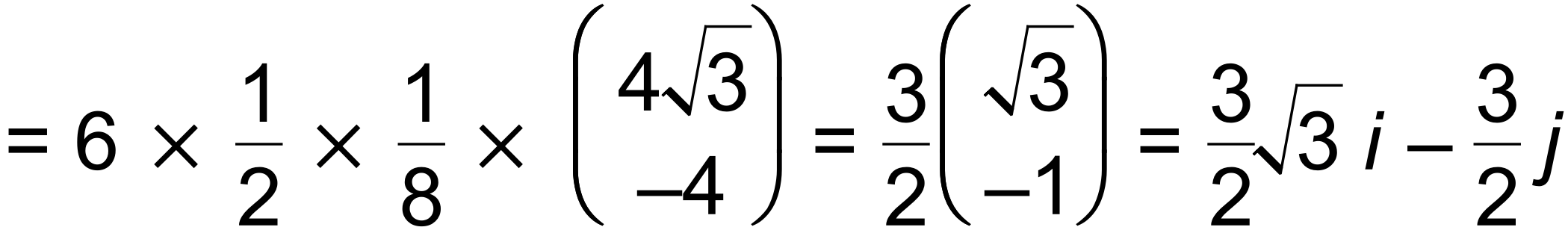
8.

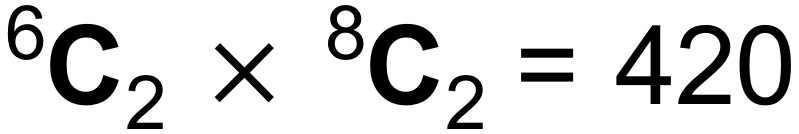
✓ diagram(s)

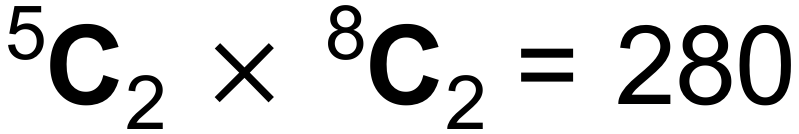
 ✓

 ✓

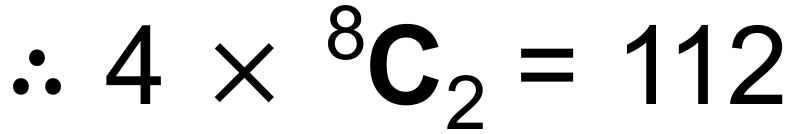
 ✓

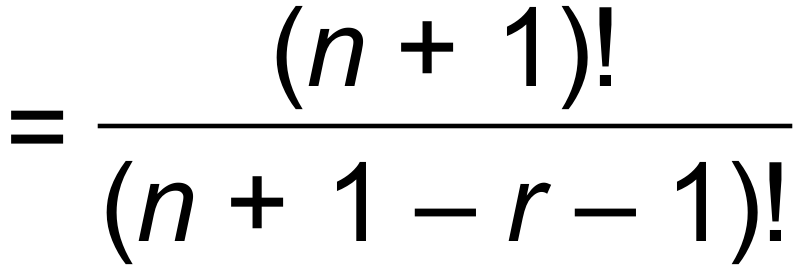
 ✓ [5]

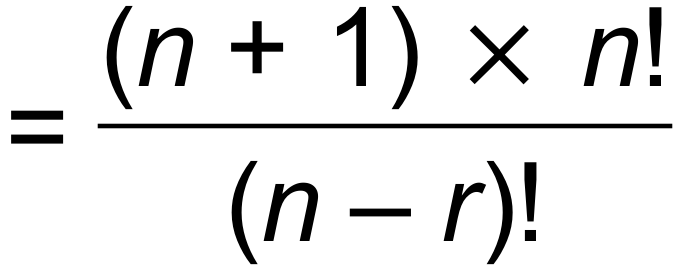
9. (a)  ✓✓

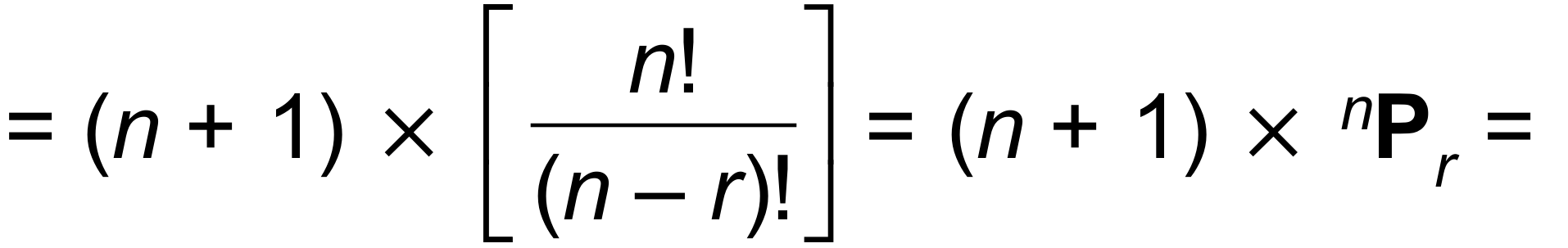
(b) (i)  ✓✓

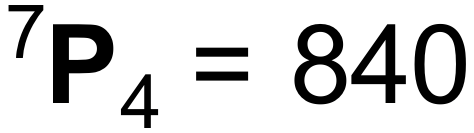
(ii) only choices are AB, DE, DF and EF ✓

 ✓✓ [7]

10. (a) LHS  ✓

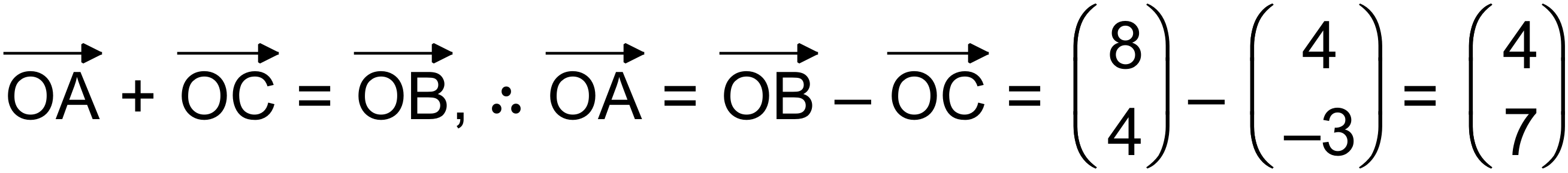
 ✓

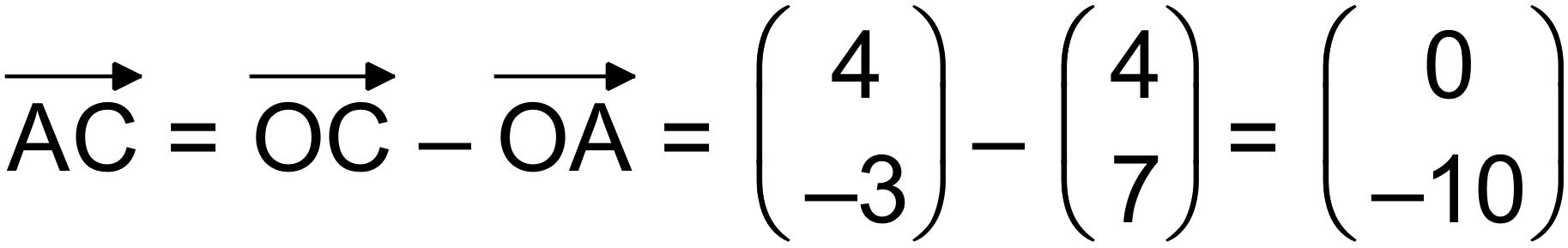
 RHS ✓

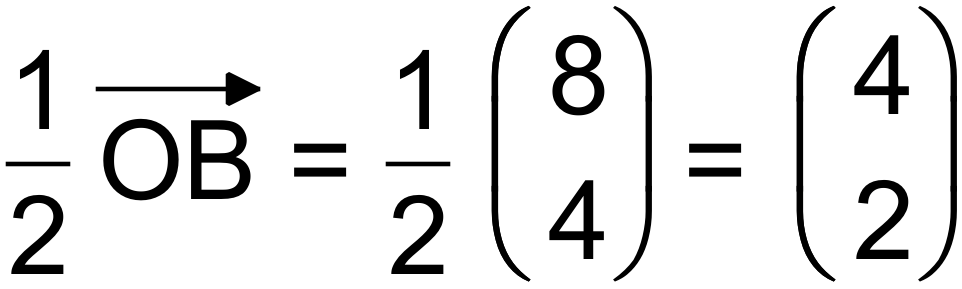
(b) (i)  ✓

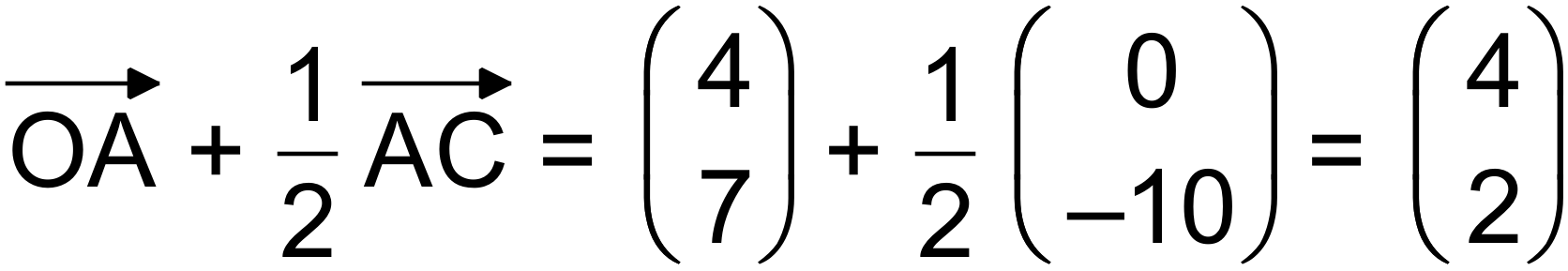
(ii)  ✓✓

(iii)  ✓✓ [8]

11. (a)  ✓

 ✓

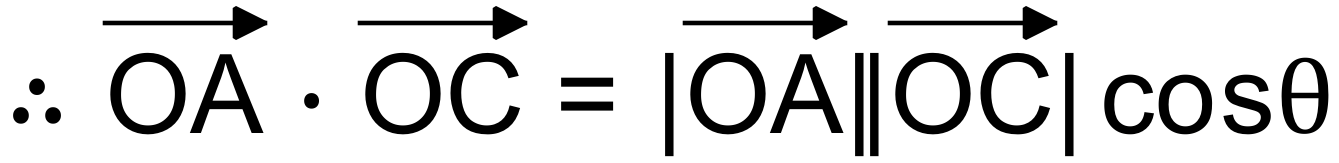
(b)  ✓

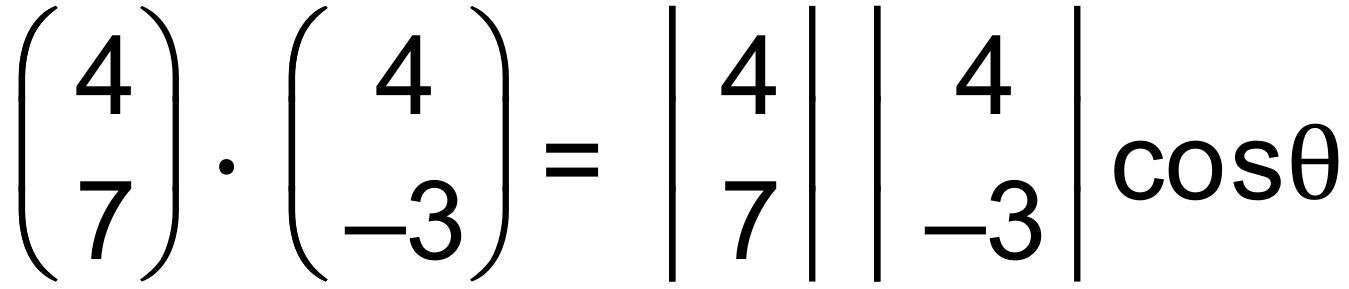
 ✓✓

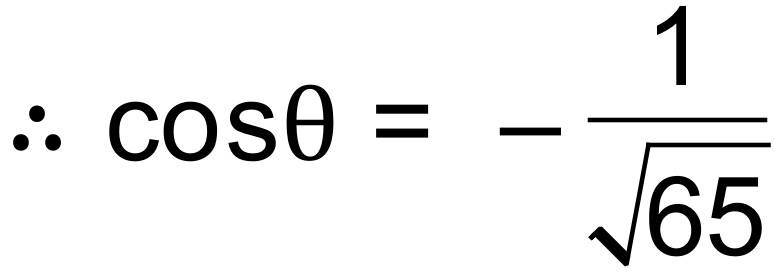
(4, 2) is the midpoint of both OB and AC ✓

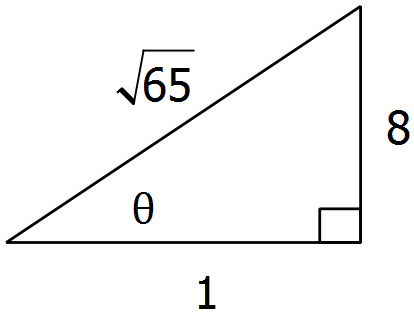
Therefore, OB and AC bisect each other.

(c)  since OABC is a parallelogram

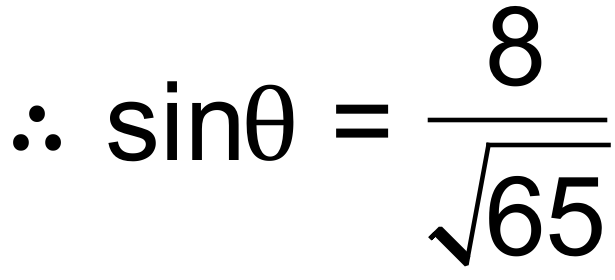


 ✓

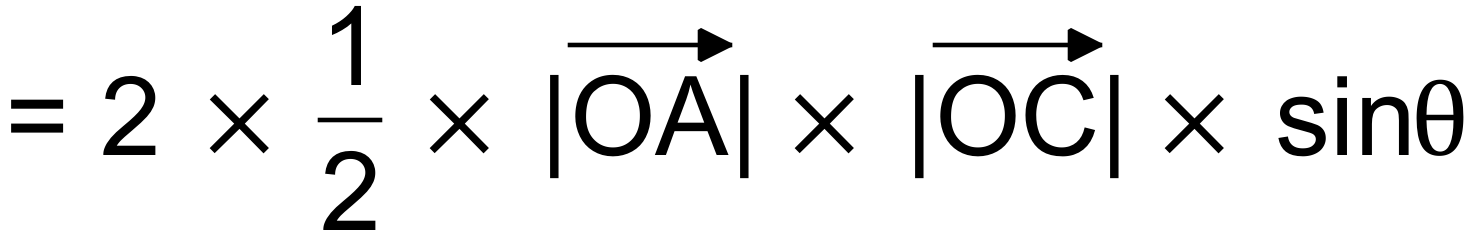
 ✓

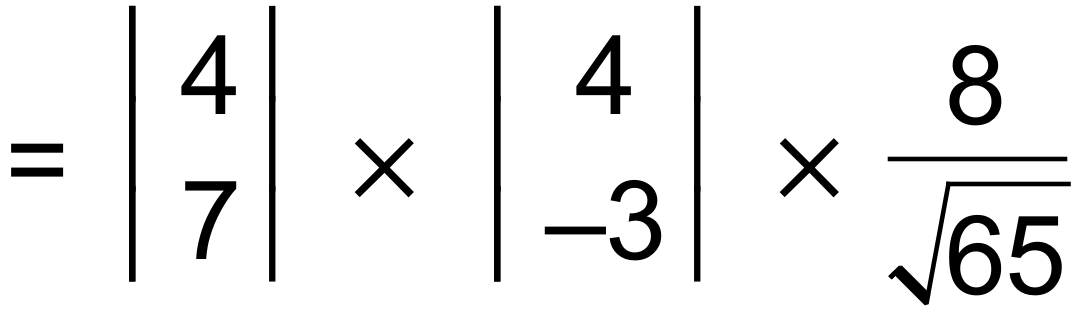


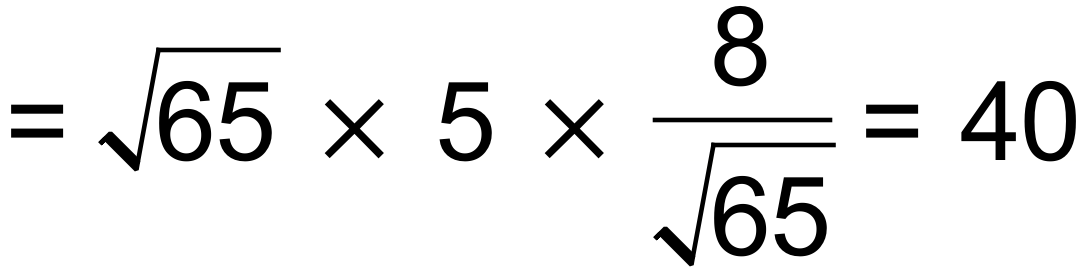
(d) From (c):

 ✓

(e) Area OABC = 2 × Area ∆OAC



 ✓

 units2 ✓ [11]

12. (a) (i) For all natural/counting numbers represented by n ✓

there exists another natural number m ✓

such that n is the square of m

OR such that m is a whole number root of n. ✓

12. (a) (ii) 5 is natural and there is no natural number that

when squared gives 5.

(any acceptable answer) ✓

(b) A rhombus has two pairs of parallel sides,

therefore B A is a valid statement. ✓

Not all parallelograms are rhombi, e.g. rectangles,

therefore A B is not a valid statement. ✓

Hence, A is not equivalent to B, i.e. A B is invalid. ✓

(c) (i) If a triangle inscribed in a circle is right angled, then

the triangle has the diameter as one of its sides. ✓

(ii) Yes, because ALL right-angled triangles inscribed

in a circle will have the diameter as the hypotenuse. ✓

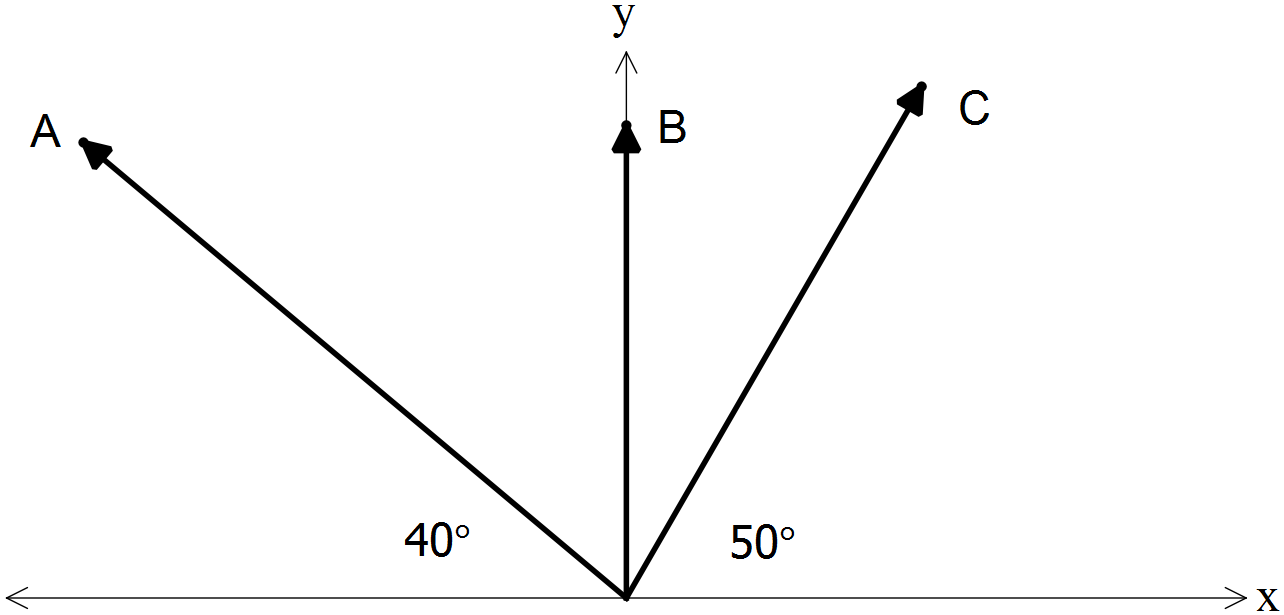
(iii) If a triangle inscribed in a circle does not have the

diameter as one of its sides, then the triangle is not

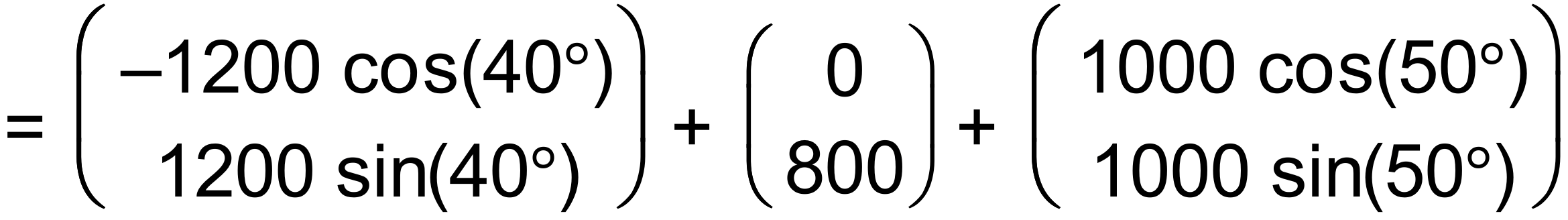
right angled. ✓

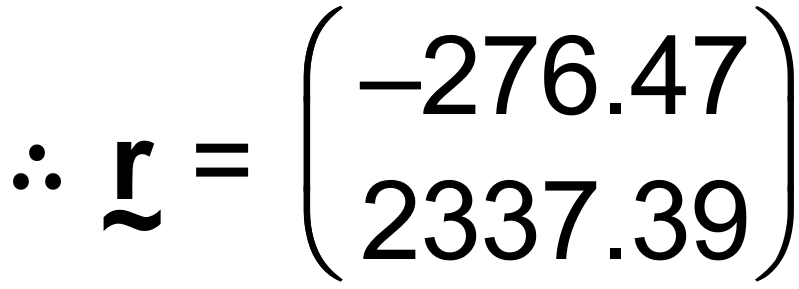
(iv) Yes, because if a statement is true then so is the

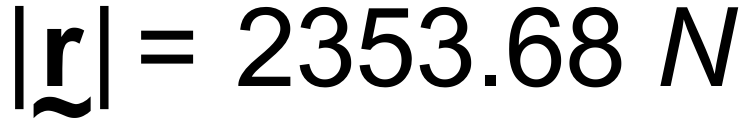
contrapositive of that statement ✓ [11]

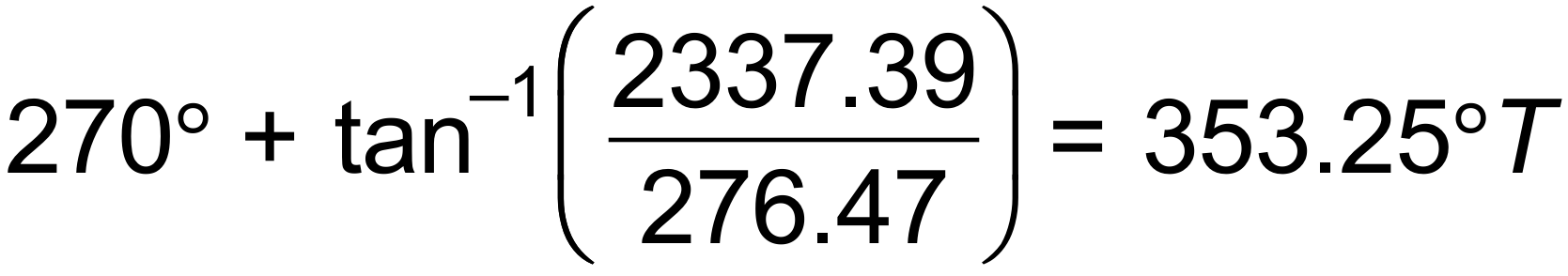
13. (a)

Combined force vector: 

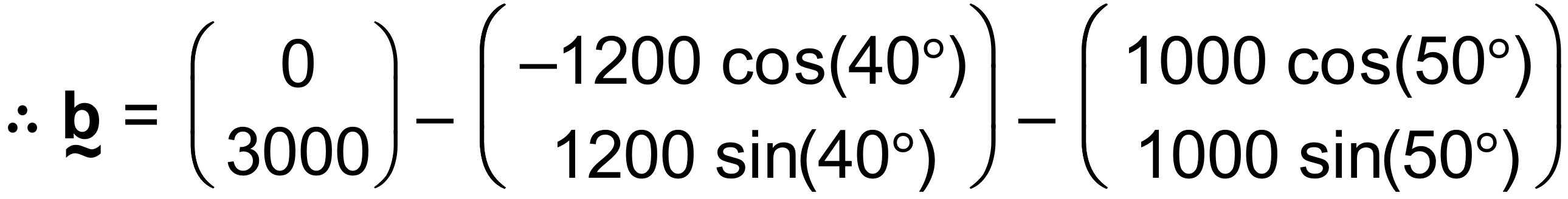
 ✓✓✓

 ✓

and  ✓

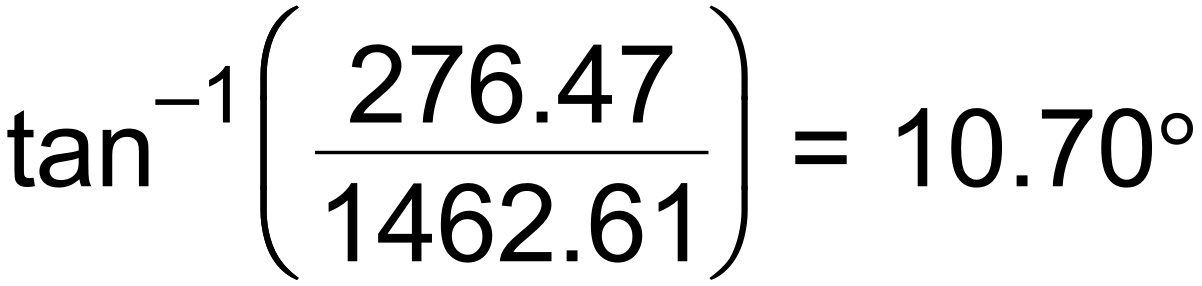
bearing =  ✓

13. (b)  ✓

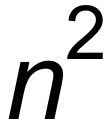


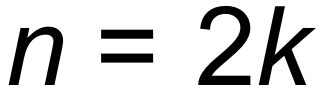
 ✓

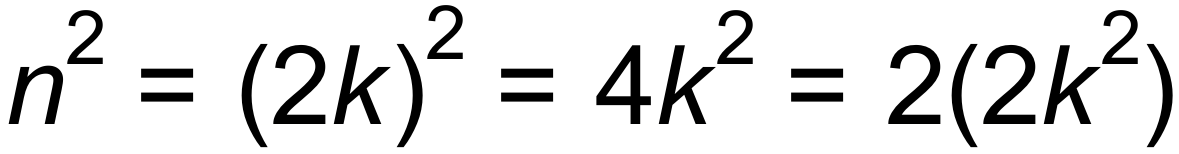
maximum force =  ✓

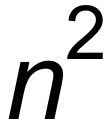
bearing = 

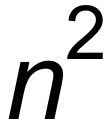
∴ 79.30°T ✓ [10]

14. (a) Assume that *n* is even and  is odd. ✓

Then  such that  ✓

Thus, 

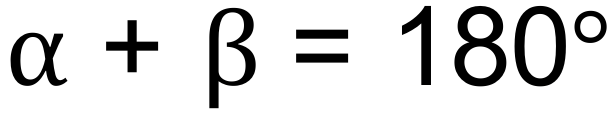
which implies that  must be even. ✓

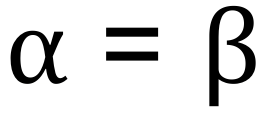
Since  cannot be both even and odd, this is a contradiction ✓

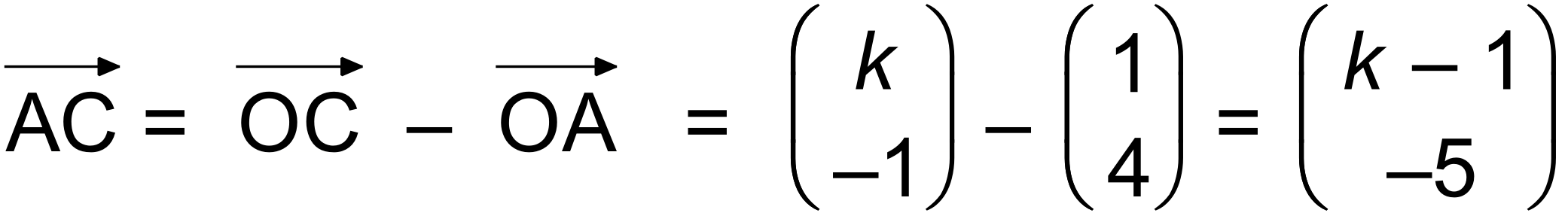
and therefore *n* must be even.

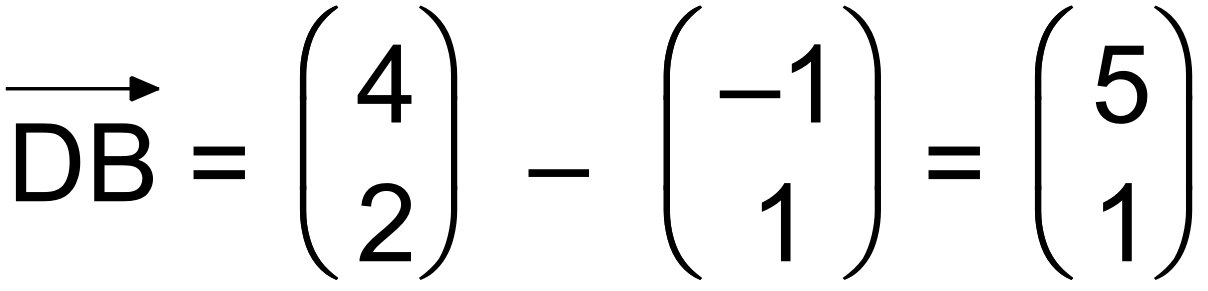
(b)  ✓

 ✓

and hence  as required ✓

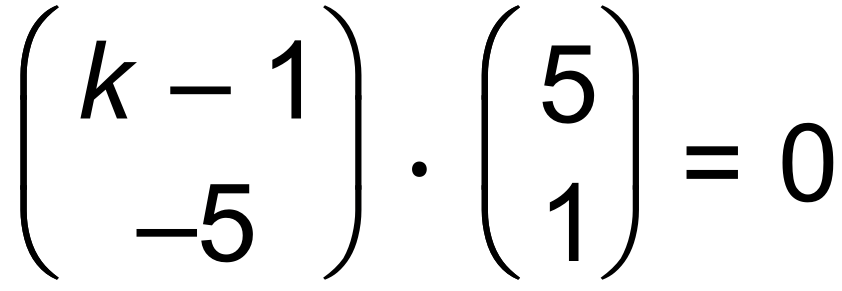
 if O,B,D are collinear OR DB=diameter ✓ [8]

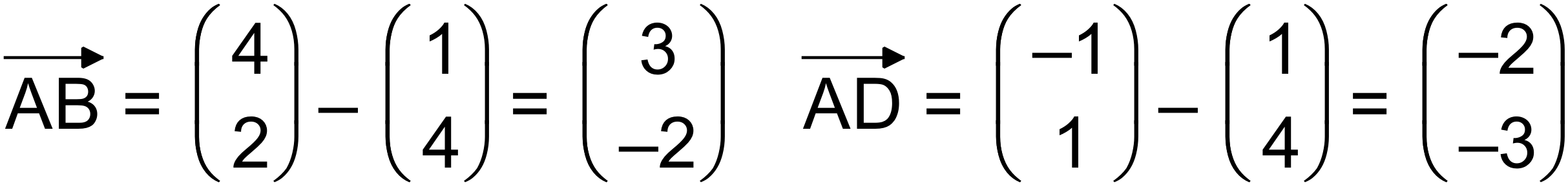
15. (a)  ✓

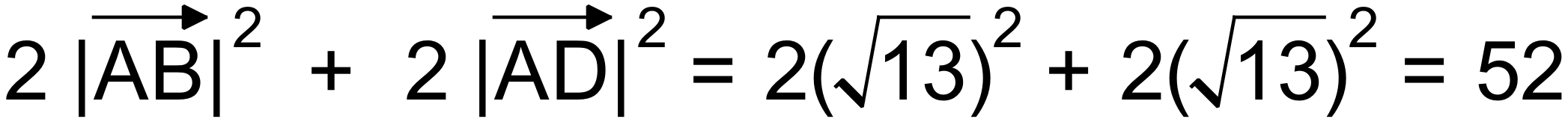
 ✓

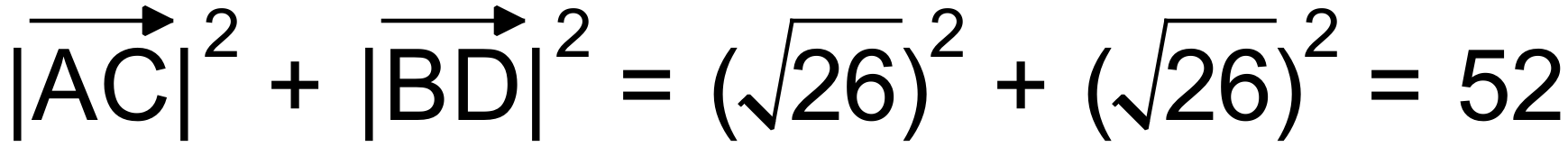
(b) In a rhombus the diagonals are perpendicular.

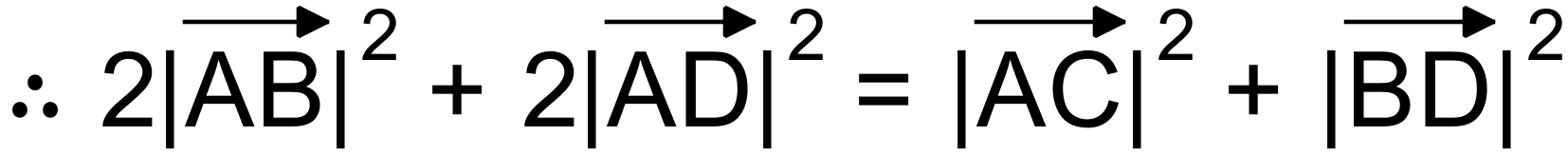
 ✓

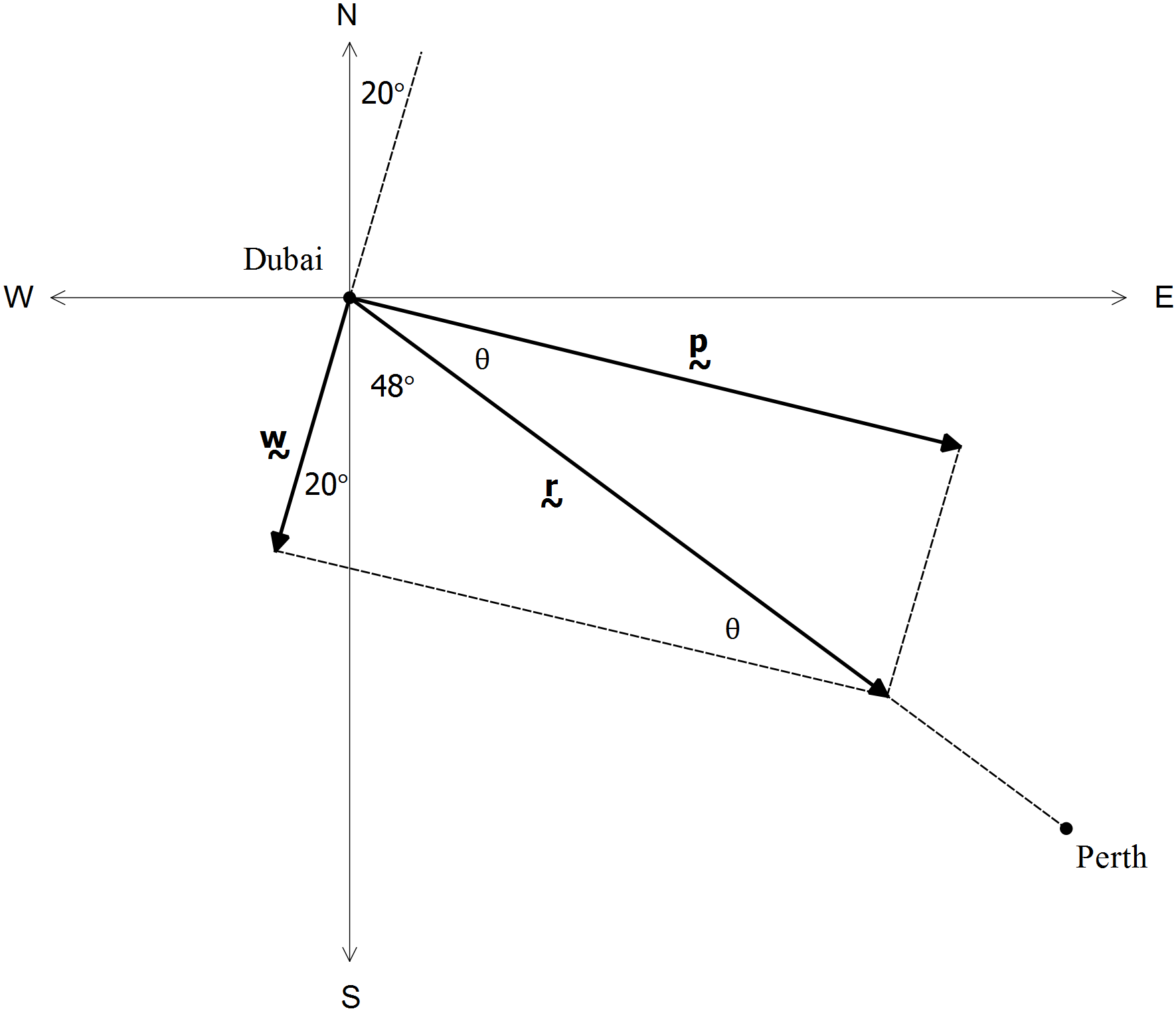
 hence  ✓

(c)  ✓

 ✓

 ✓

 as required. [7]

16. (a)

✓ wind vector

✓ plane vector

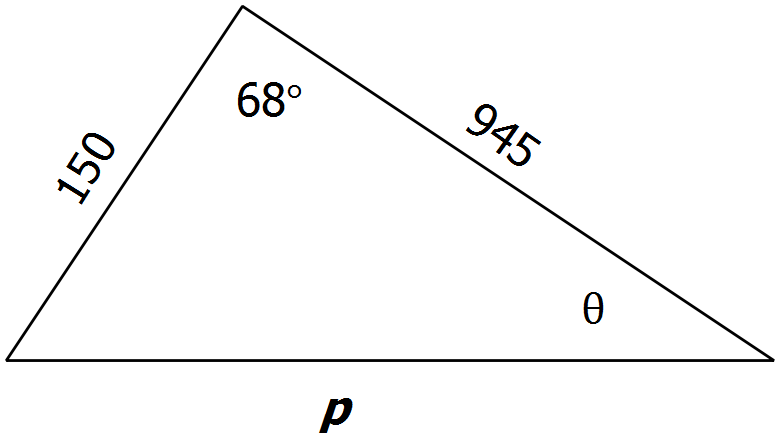
✓ flight direction

and resultant

vector using

parallelogram

method

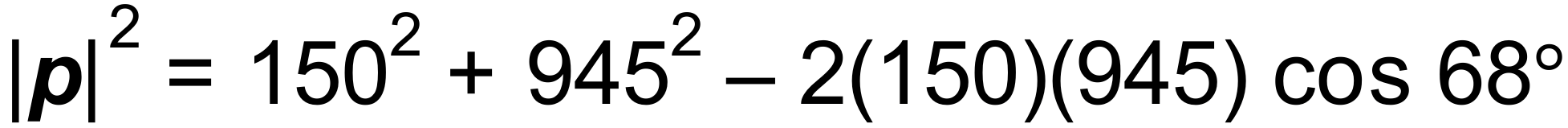
 (b)

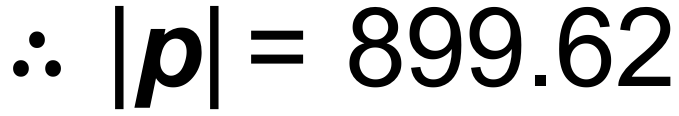
✓ 68° angle

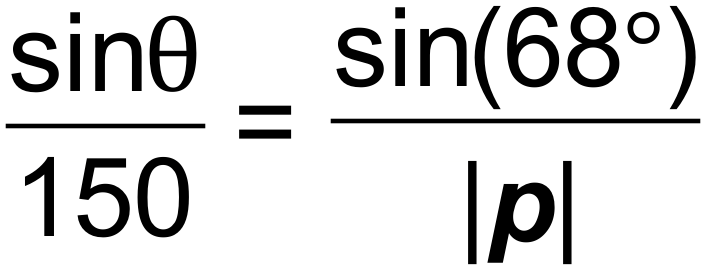
between wind

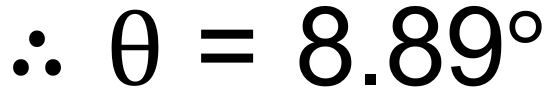
and plane

✓ speeds

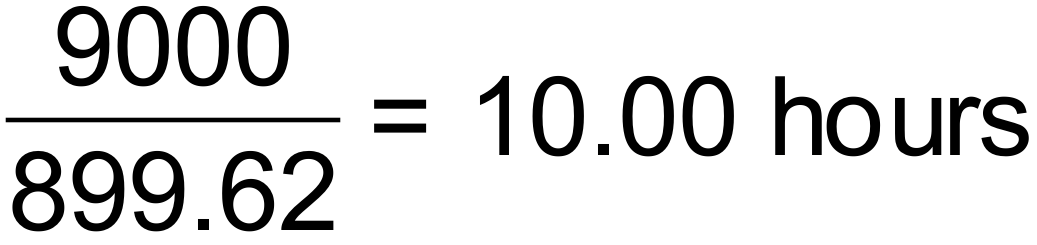
(c)  ✓

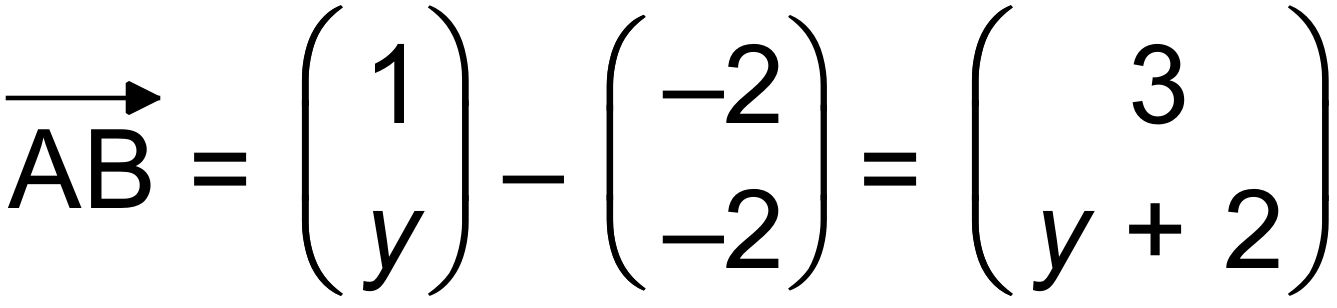
 km/h ✓

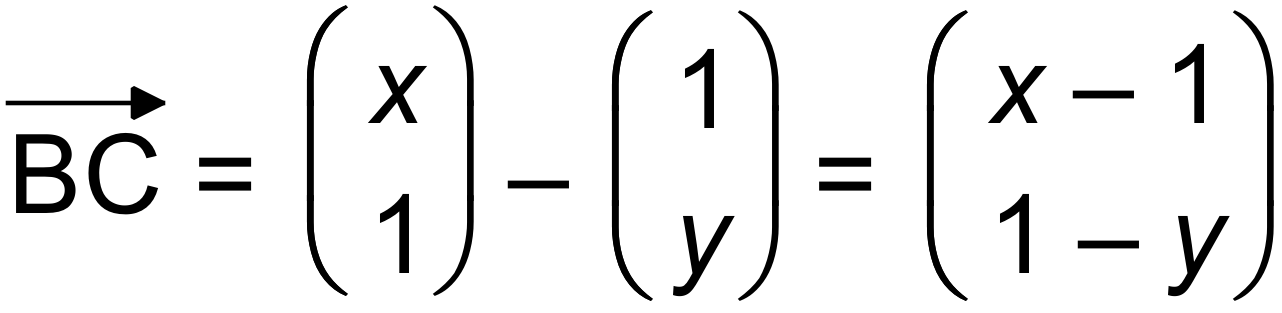
 ✓

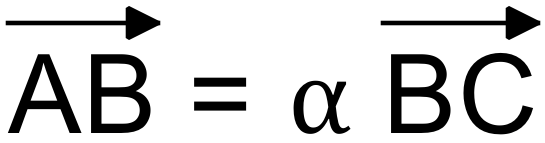
 ✓

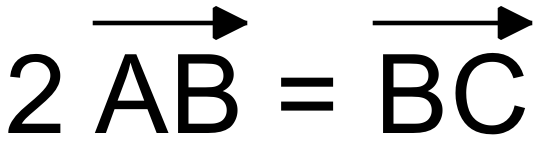
Hence, bearing = 132°– 8.89° = 123.11°T ✓

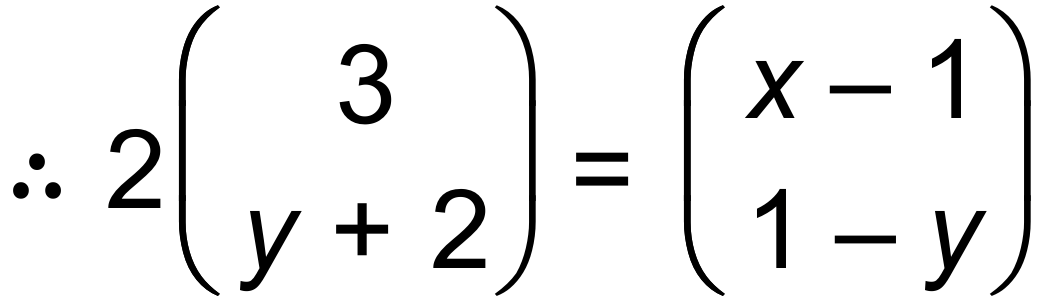
and flight duration =  ✓ [11]

17.  ✓

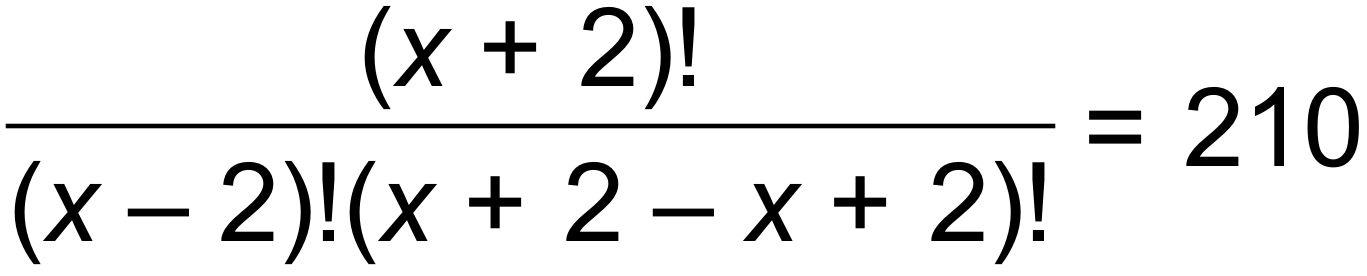
 ✓

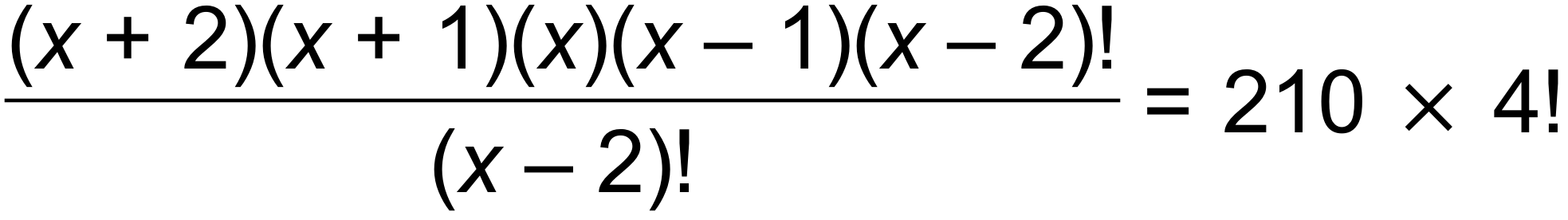
since A,B,C collinear then  ✓

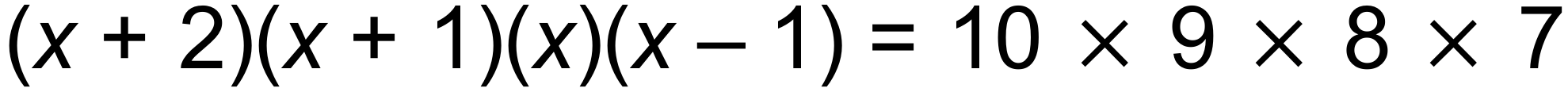
Given AB:BC = 1:2 then  ✓



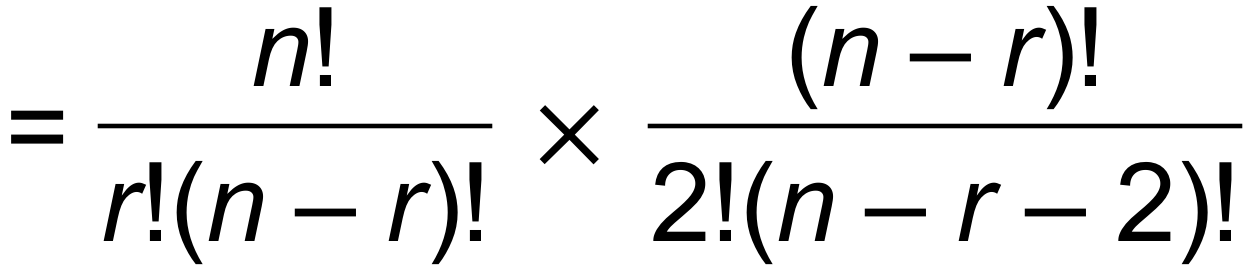
 ✓✓ [6]

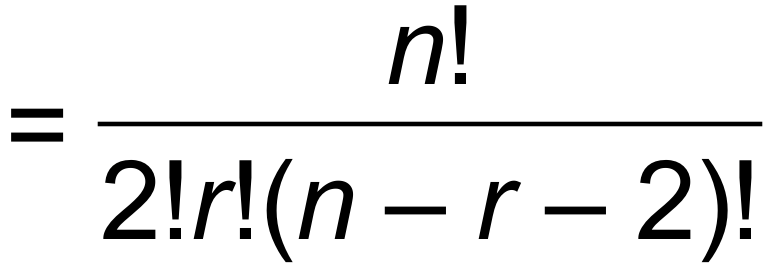
18. (a)  ✓

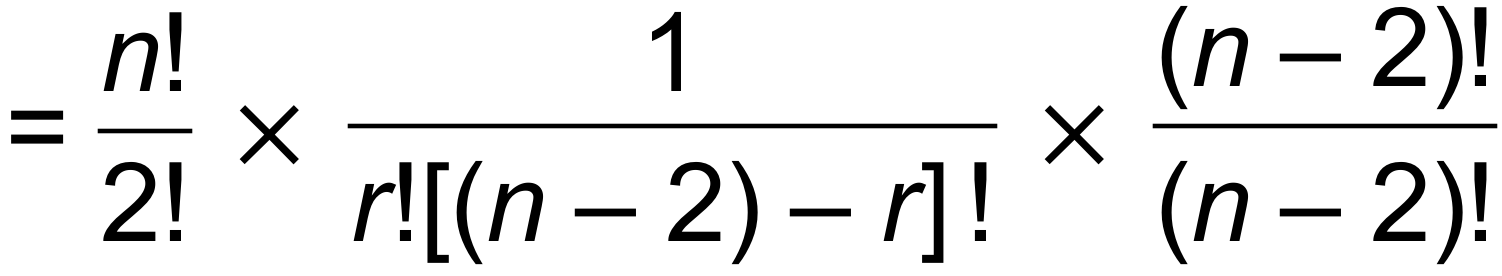
 ✓

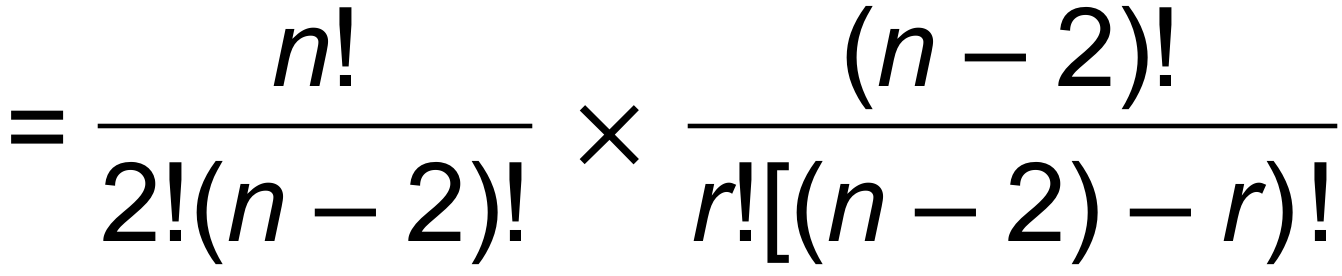


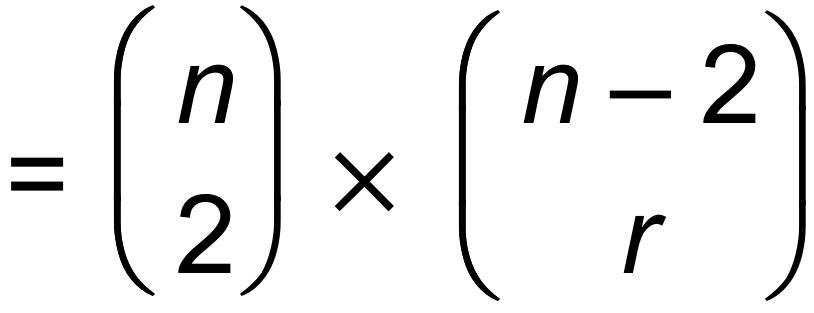
 ✓

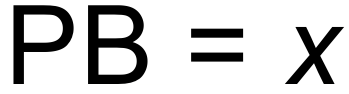
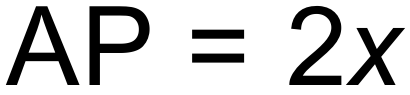
(b) LHS  ✓

 ✓

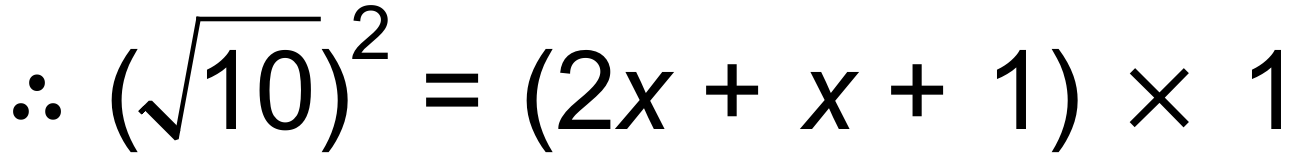
 ✓

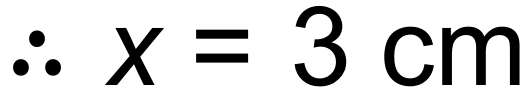
 ✓

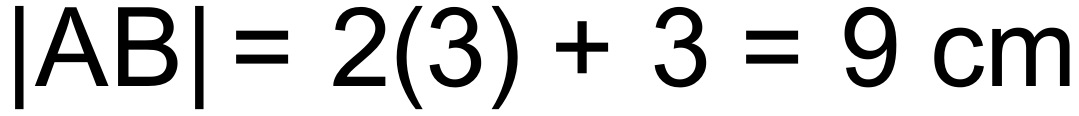
 = RHS [7]

19. (a) Let  and 



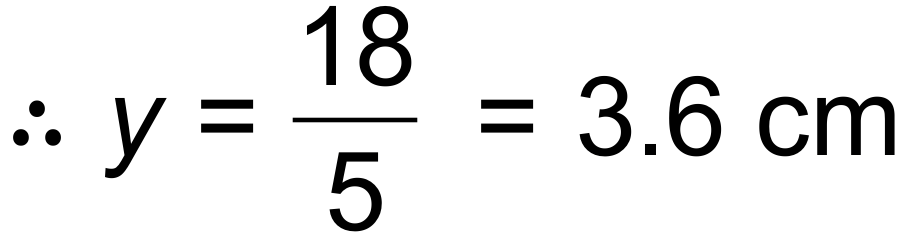
 ✓

 ✓

and hence  ✓

(b) 

 ✓

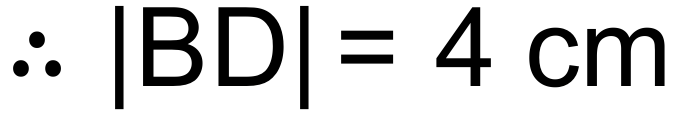
 ✓

and hence  ✓

(c) ∆PBD is right angled since ∆ABD is right angled (triangle in semicircle)

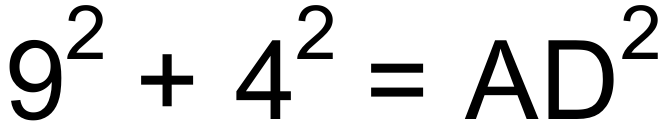


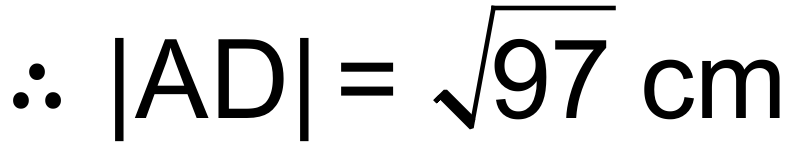


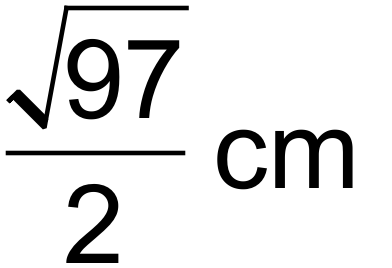
 ✓

(d) ∆ABD is right angled in semicircle

 ✓





hence, radius is  ✓ [9]