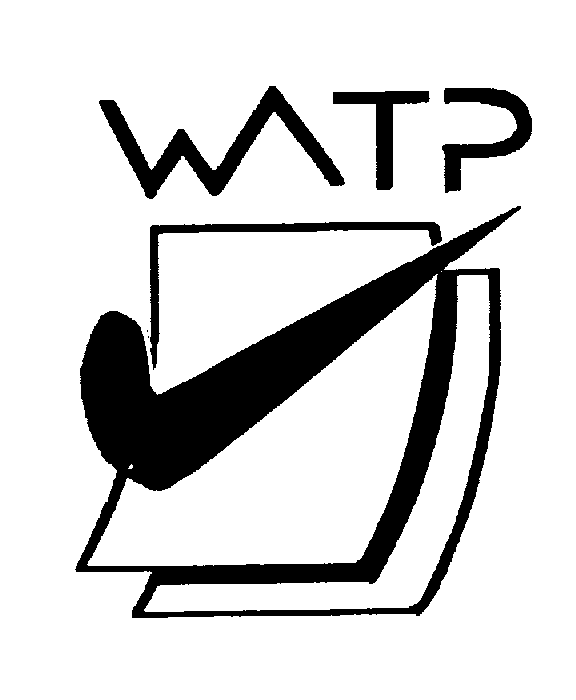
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**MATHEMATICS**

**SPECIALIST**

**UNIT 1**

**Semester One**

**2017**

**SOLUTIONS**

***Calculator−free Solutions***

1. (a) ✔



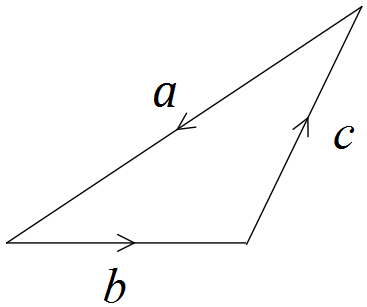
✔



✔



(b) must form a closed loop, e.g.: ✔

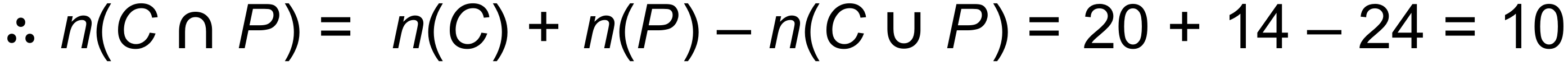


(c) III and IV ✔✔ [6]

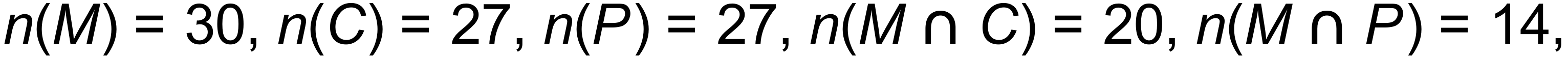
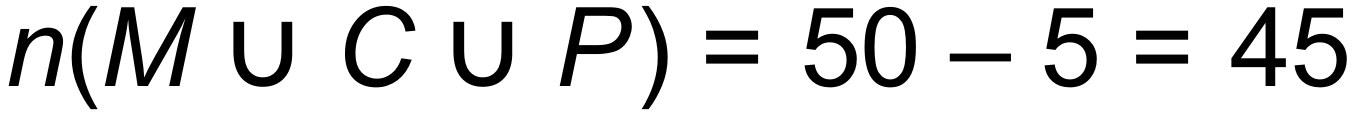
2. (a) ✔



✔✔



(b) ✔



✔



✔



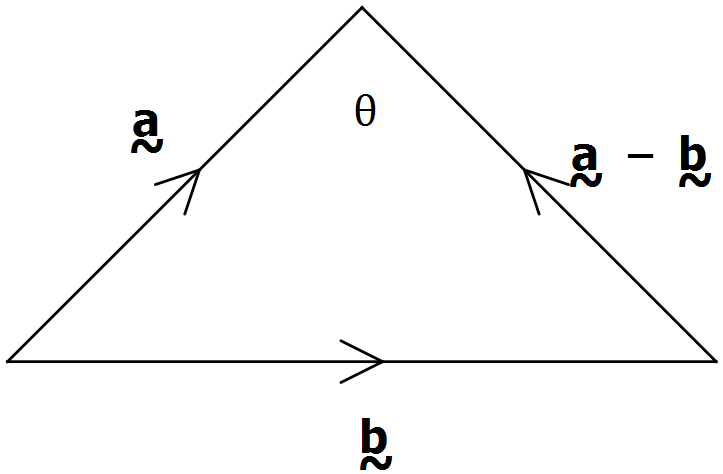
(c) 10 houses have married couples with children and pets,

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

with both children and pets. ✔

The Pigeon Hole Principle. ✔ [8]

3. (a)





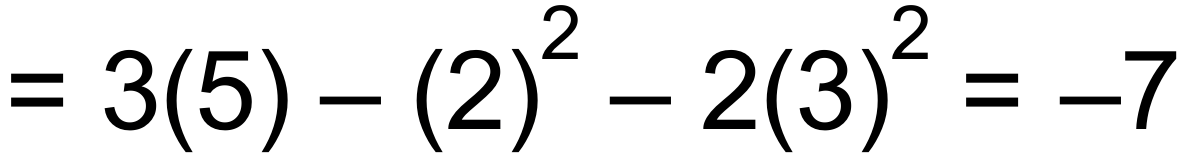
3. (b) ✔



✔

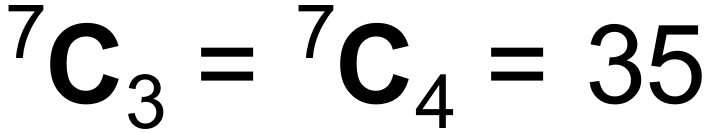


✔ [5]

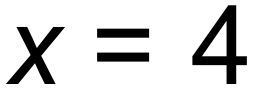


4. (a) (i) 20 ✔

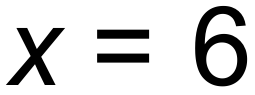
(ii) ✔



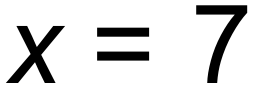
(b) (i) ; since 70 is in the 4th column of the 8th row ✔



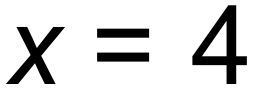
(ii) ; since 15 is in the 4th column of the 6th row ✔



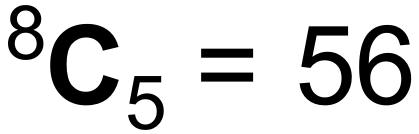
(iii) ; since in row 7, elements on columns 2 and 5 are equal ✔



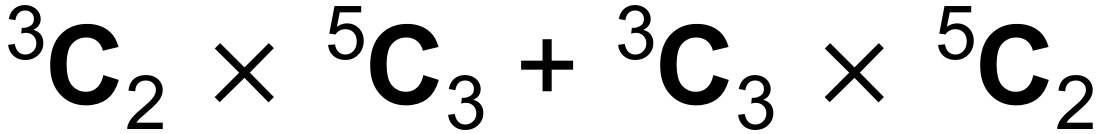
(iv) ; since in row 8, elements on columns 2 and 6 are equal ✔



(c) (i) ✔



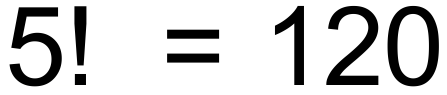
(ii) ✔✔



✔



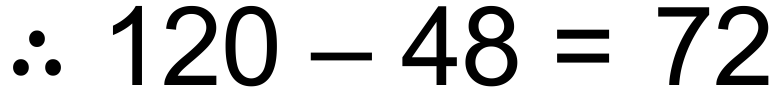
(d) (i) ✔



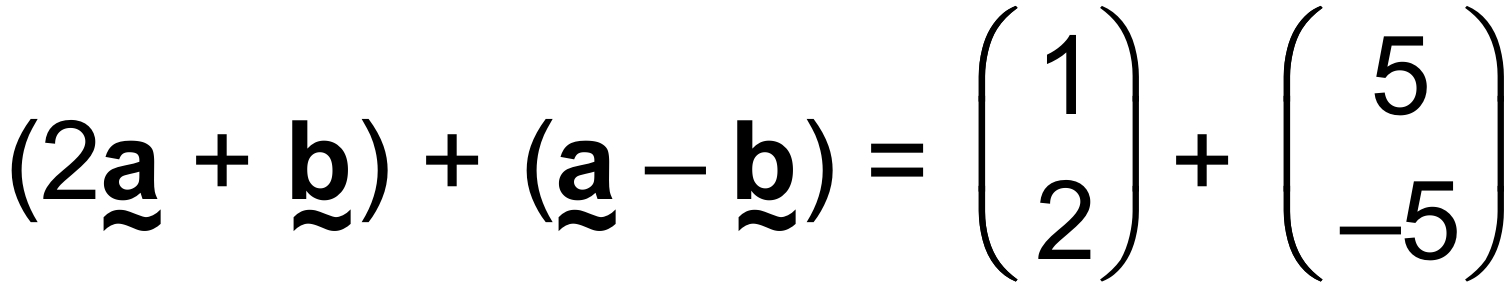
(ii) ✔



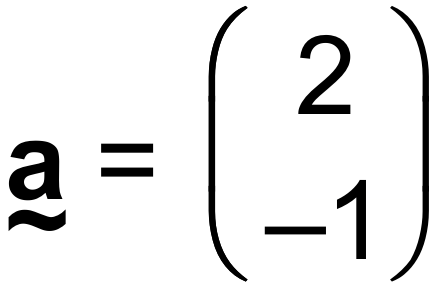
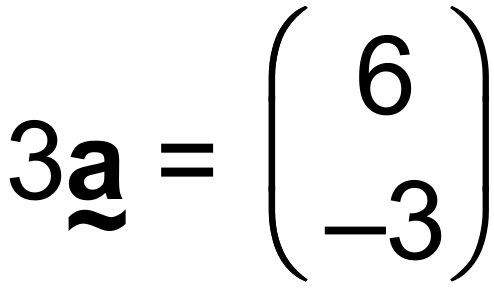
✔ [13]



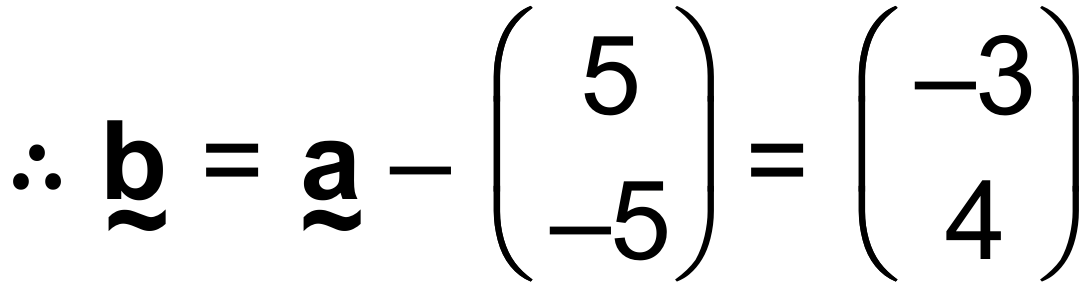
5. (a)



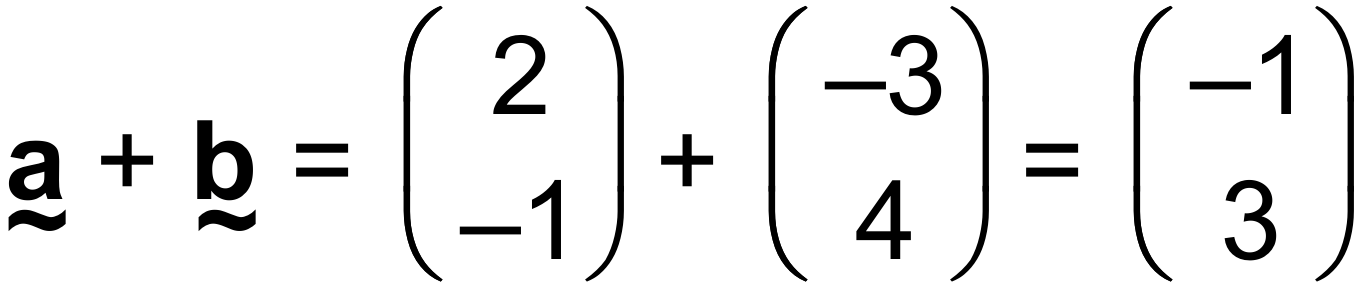
, hence ✔✔



✔

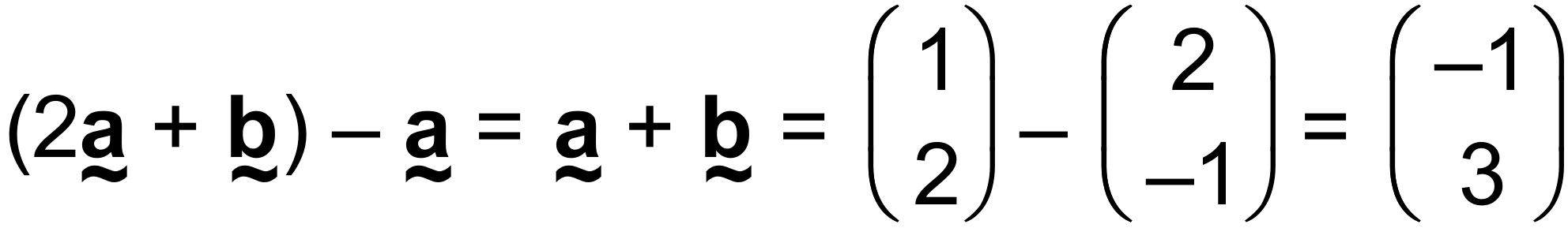


Hence, ✔

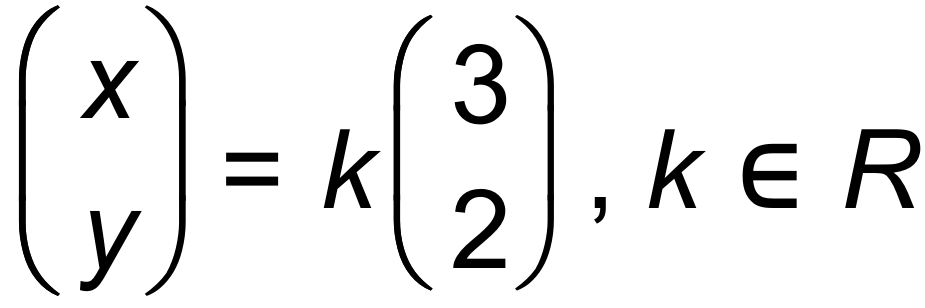
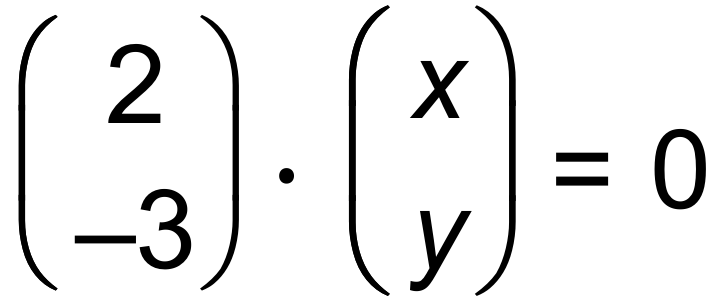


OR

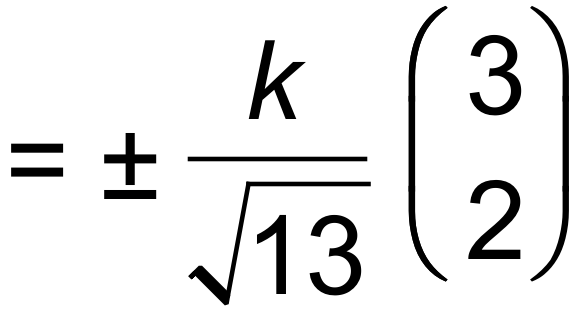
✔✔



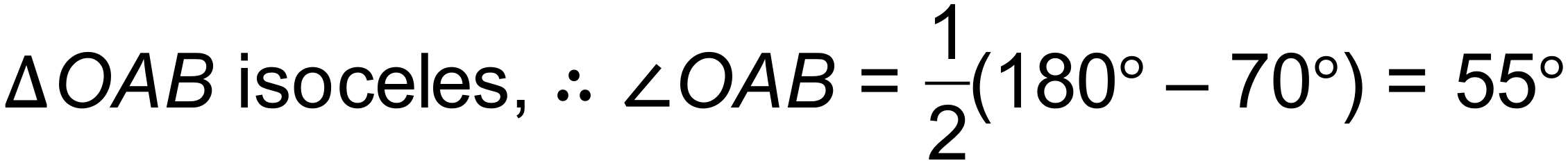
(b) , hence ✔



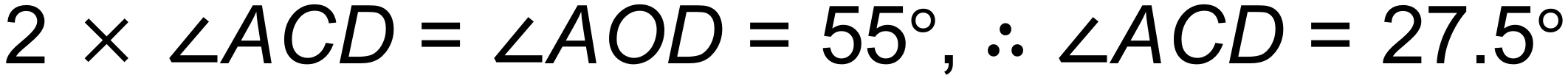
Unit vector ✔ [6]



6. (a) ✔



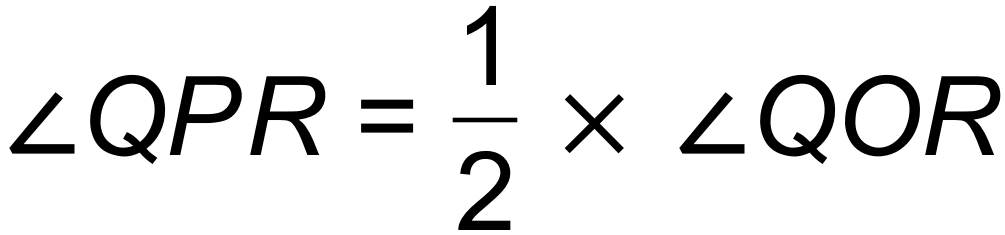
✔



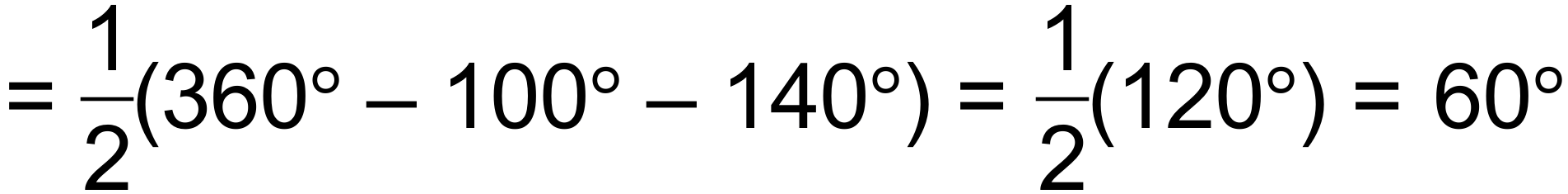
✔



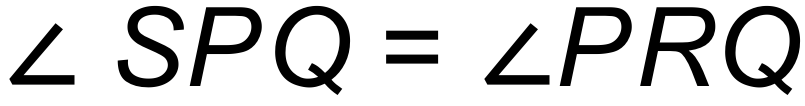
(b) (angle at circumference is half angle at the centre) ✔



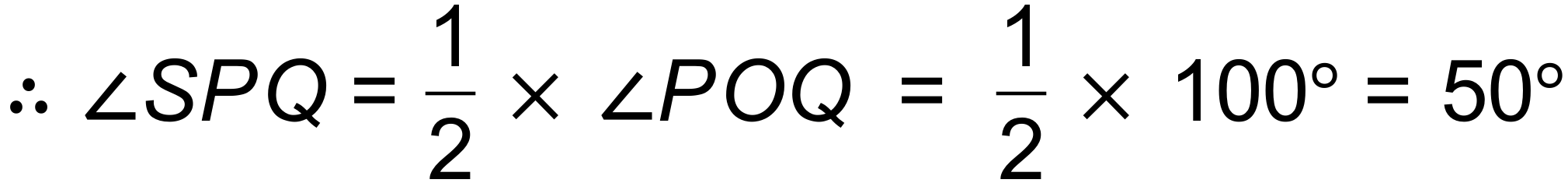
✔



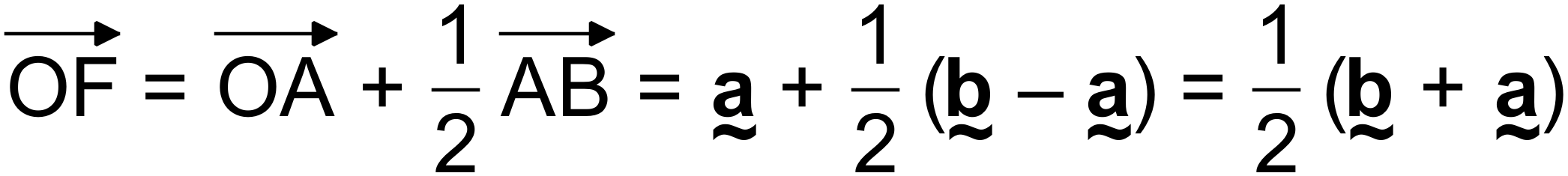
(c) from the alternate-segment theorem ✔



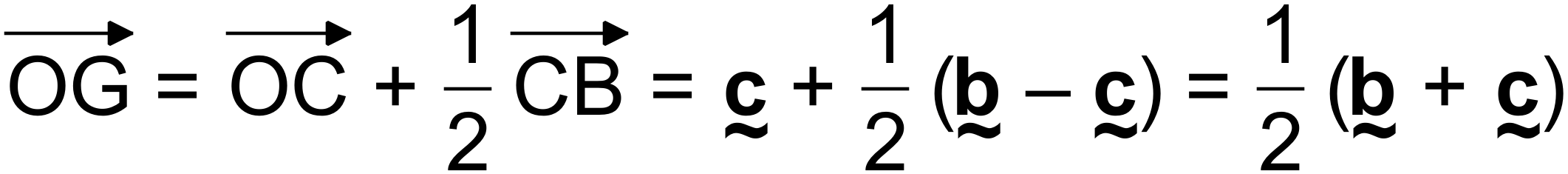
✔ [7]



7. (a) ✔

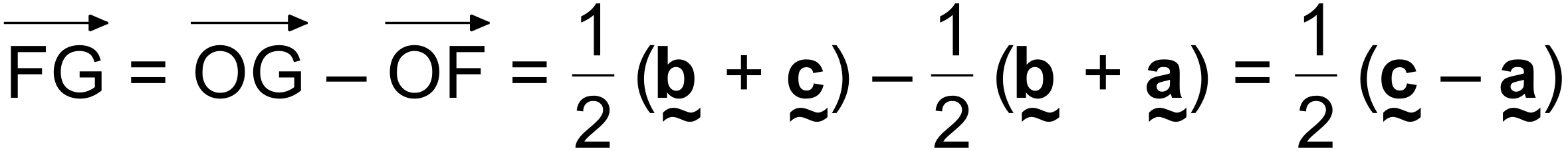
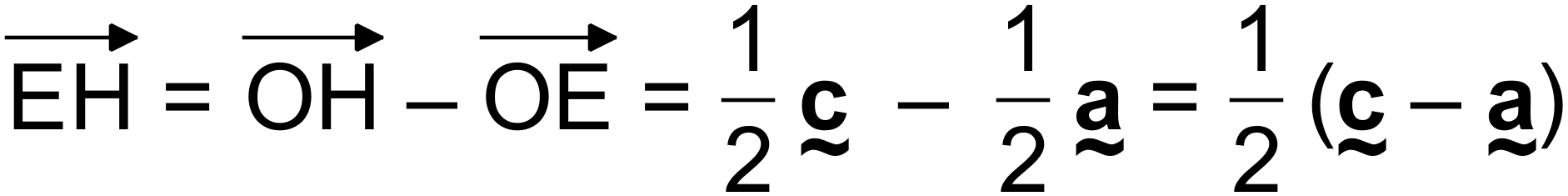


✔

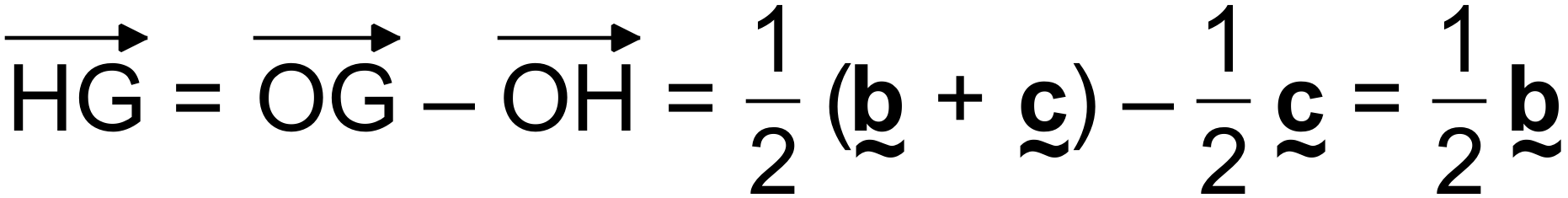
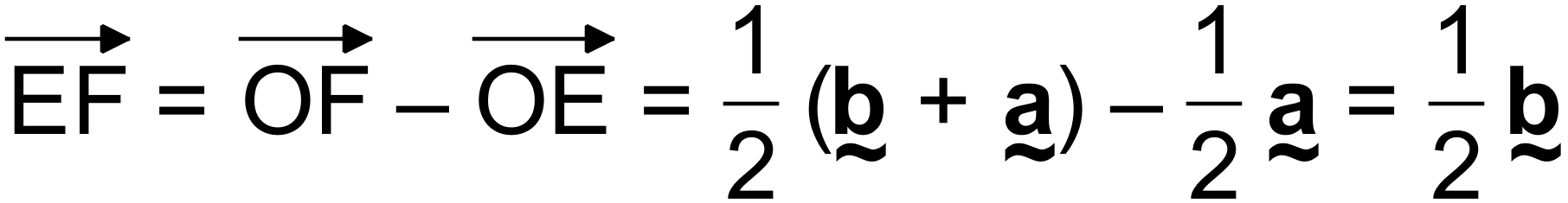
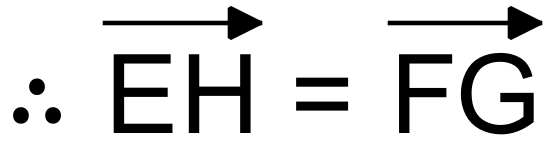


(b) Show that opposite sides are congruent and parallel:

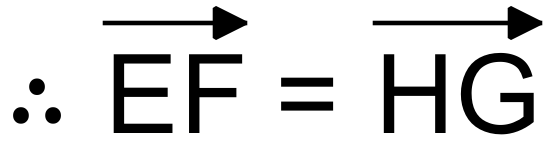
✔



as required. ✔

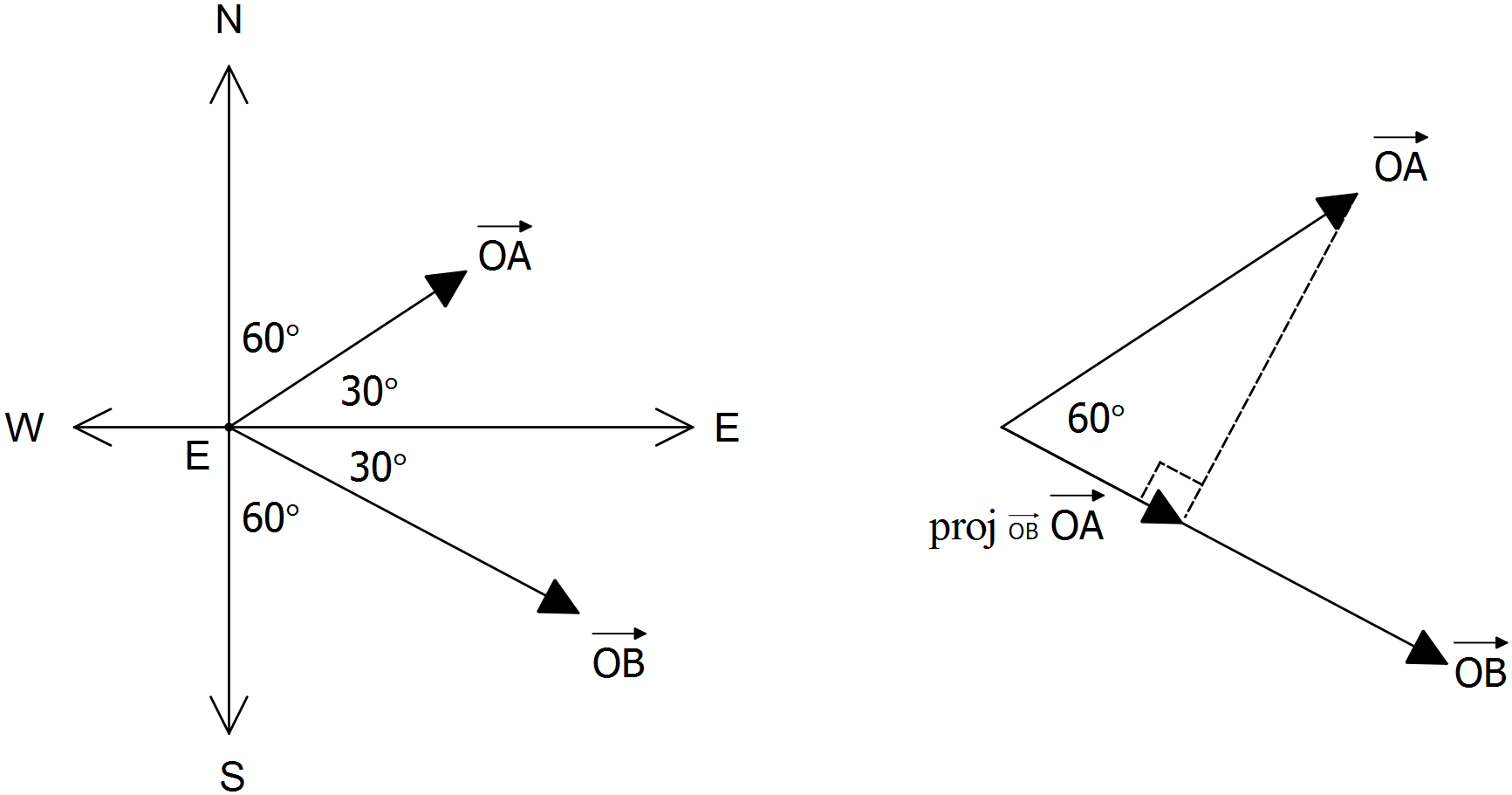


, and EFGH is a parallelogram ✔ [5]



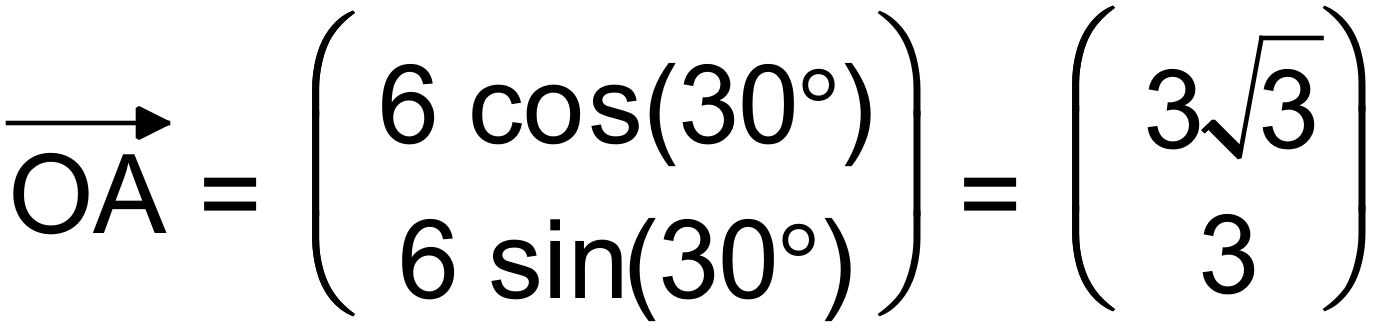
***Calculator−Assumed Solutions***

8.

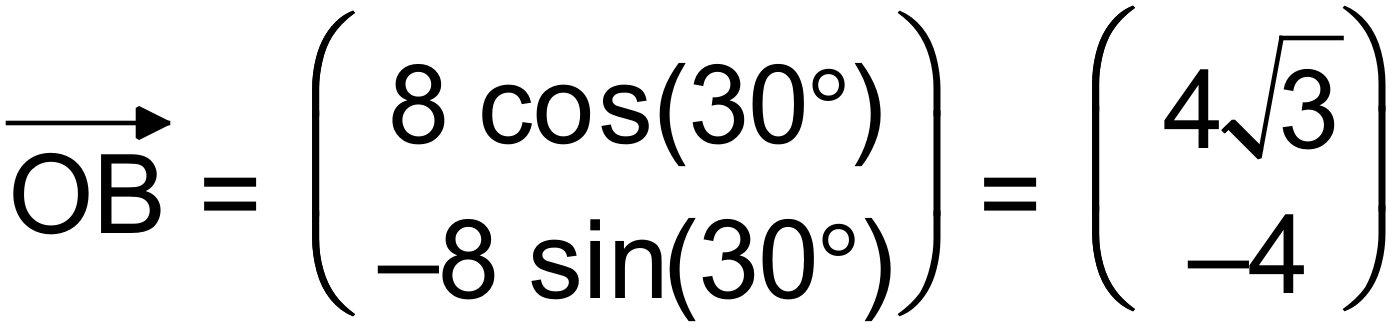




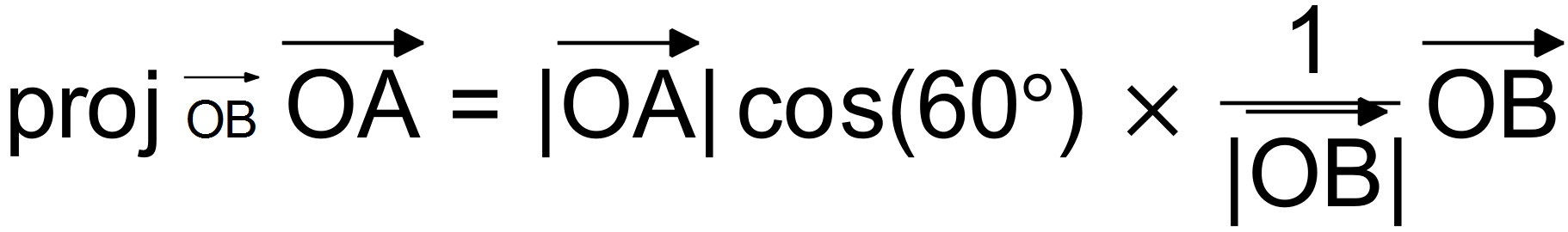
✔



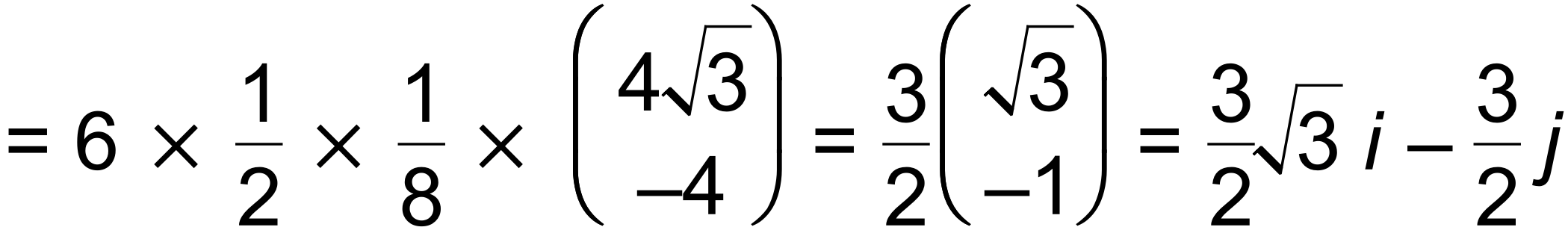
✔



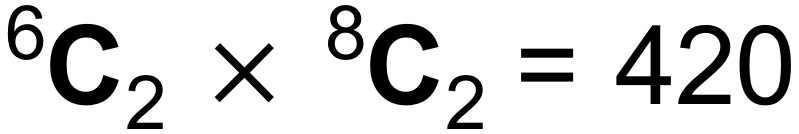
✔



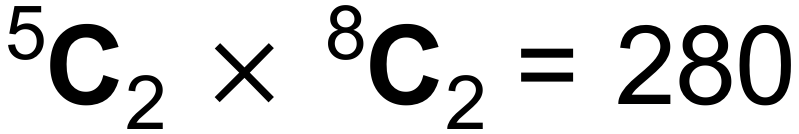
✔ [5]



9. (a) ✔✔

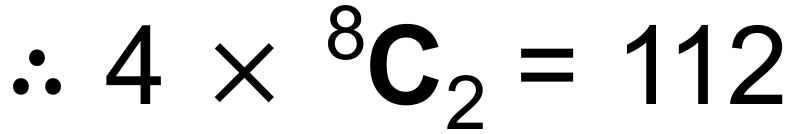


(b) (i) ✔✔

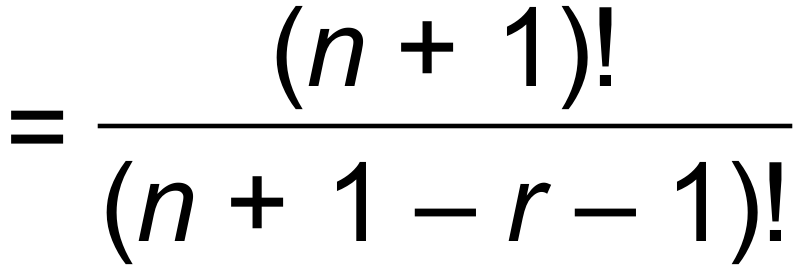


(ii) only choices are AB, DE, DF and EF ✔

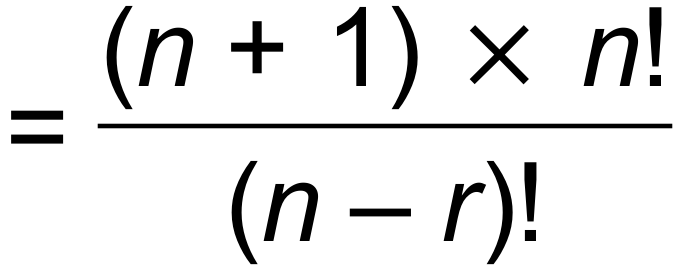
✔✔ [7]



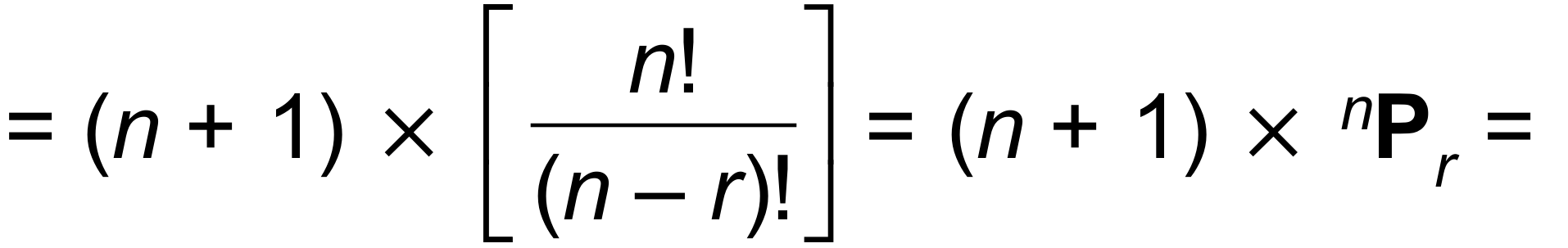
10. (a) LHS ✔



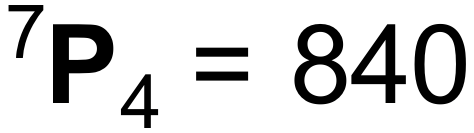
✔



RHS ✔



(b) (i) ✔



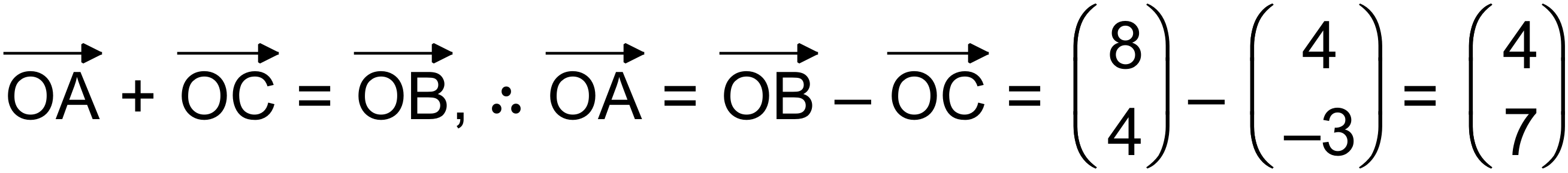
(ii) ✔✔



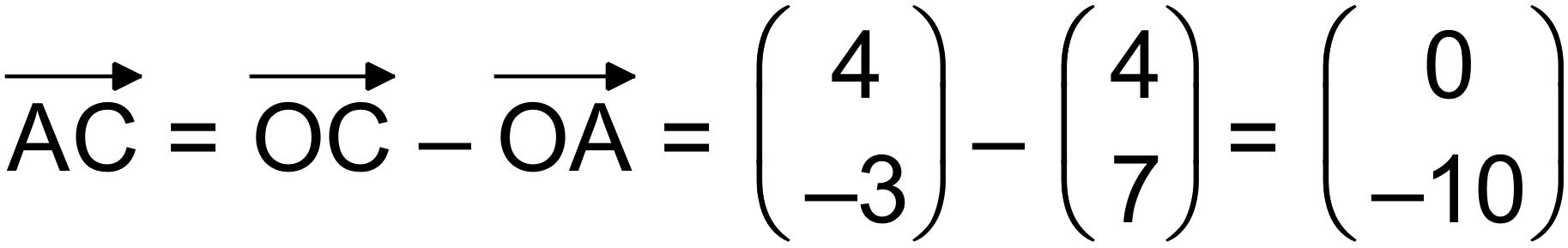
(iii) ✔✔ [8]



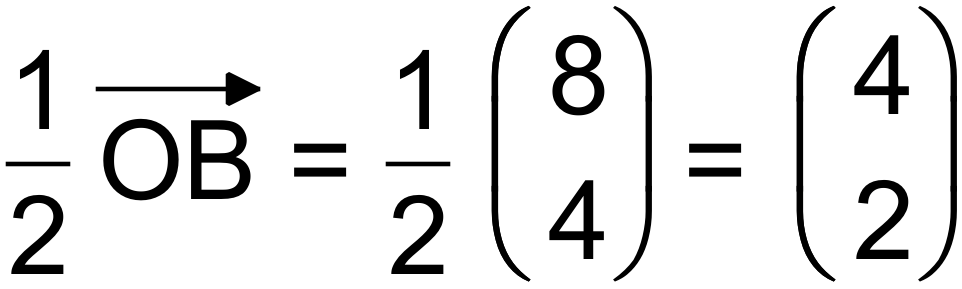
11. (a) ✔



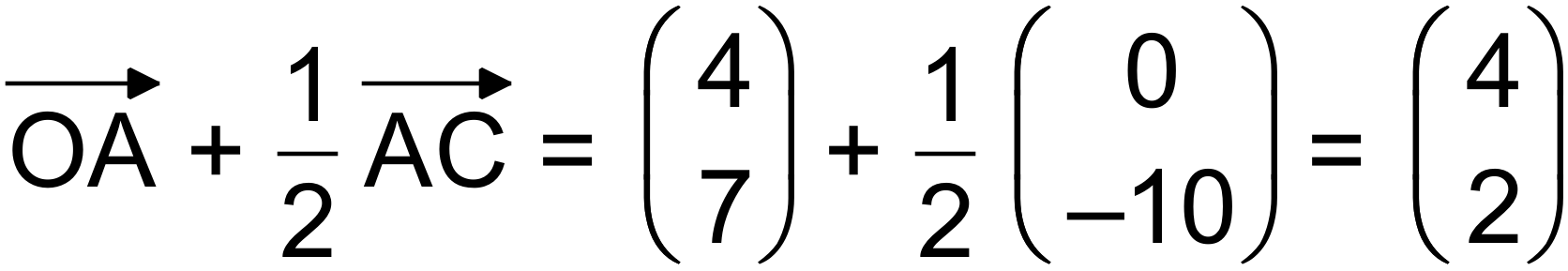
✔



(b) ✔



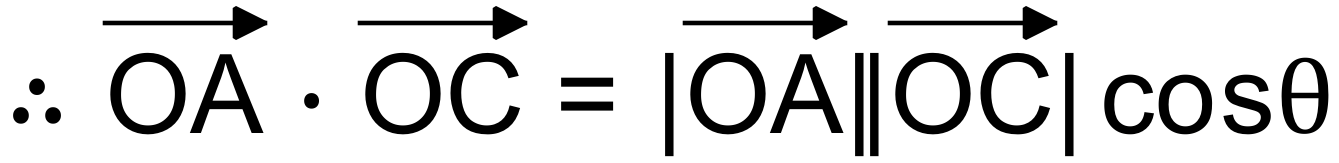
✔✔



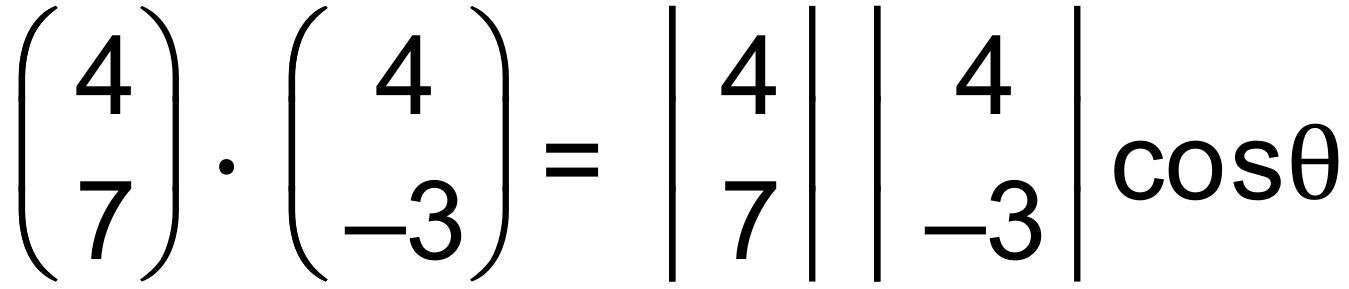
(4, 2) is the midpoint of both OB and AC ✔

Therefore, OB and AC bisect each other.

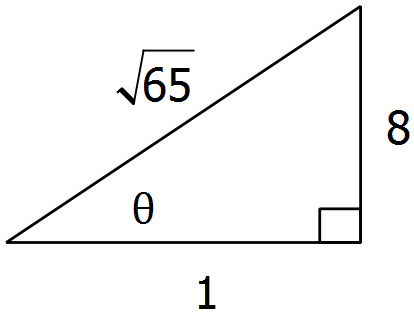
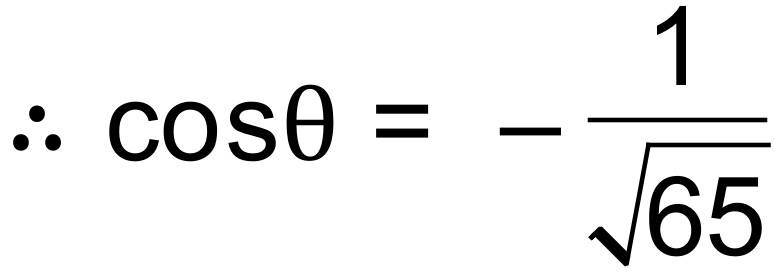
(c) since OABC is a parallelogram



✔

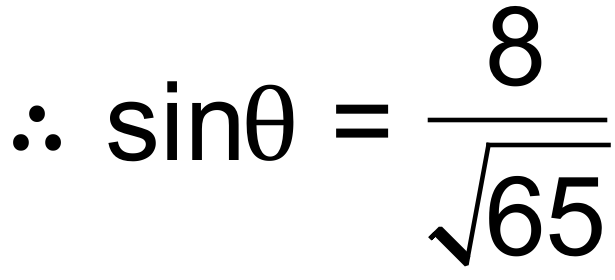


✔

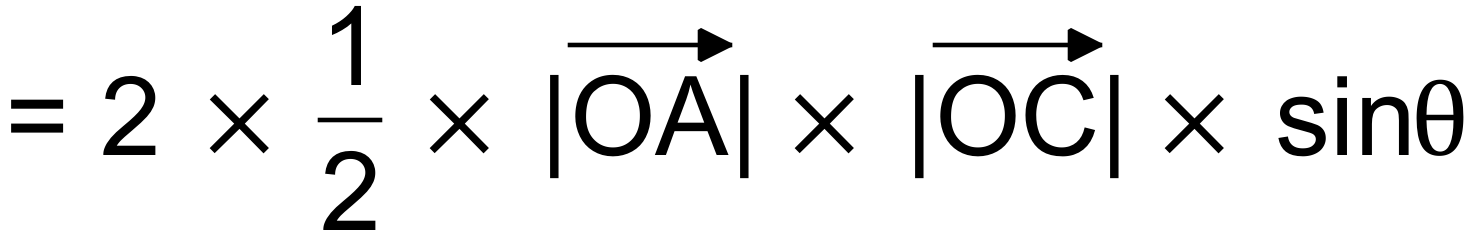


(d) From (c):

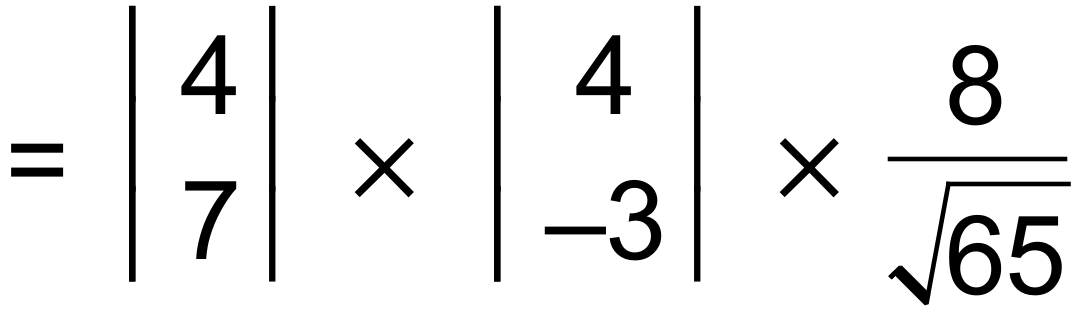
✔



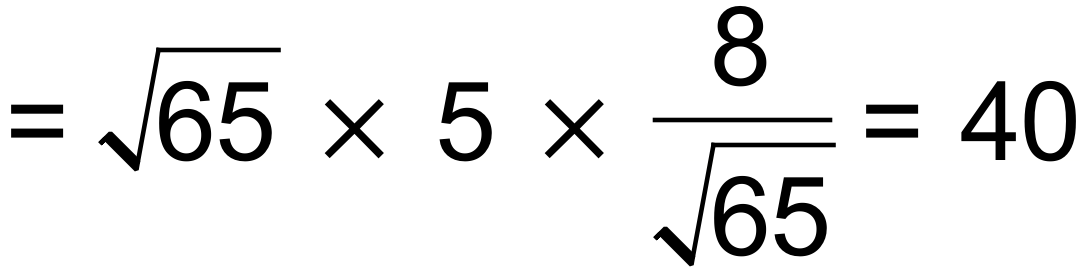
(e) Area OABC = 2 × Area ∆OAC



✔



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

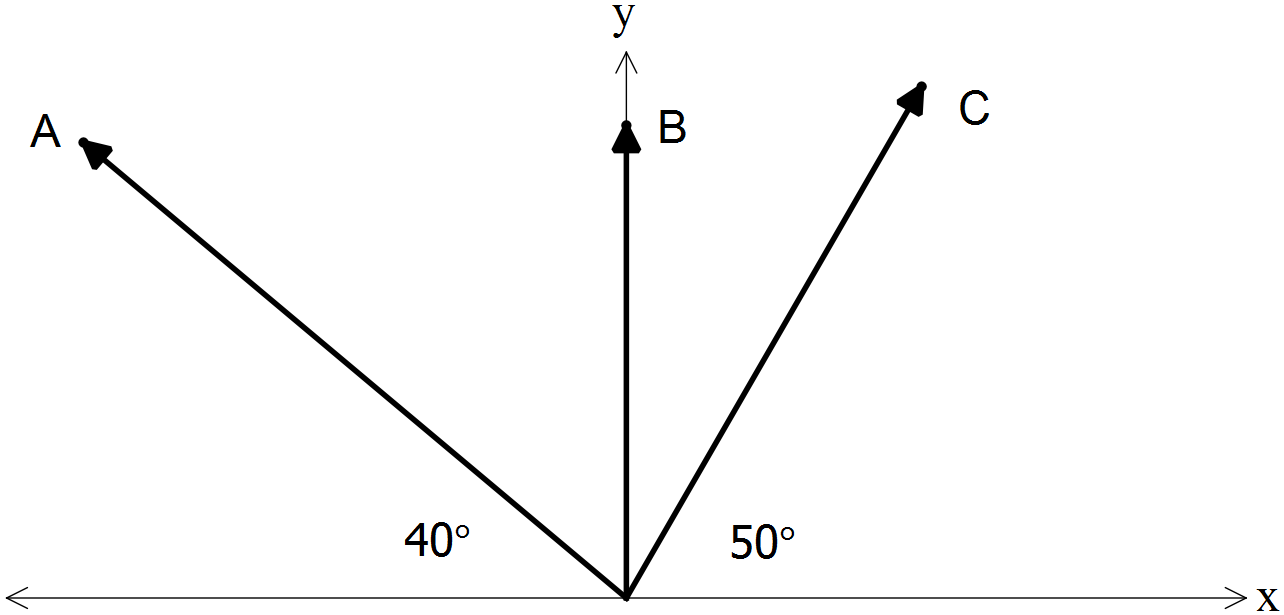
diameter as one of its sides, then the triangle is not

right angled. ✔

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

contrapositive of that statement ✔ [11]

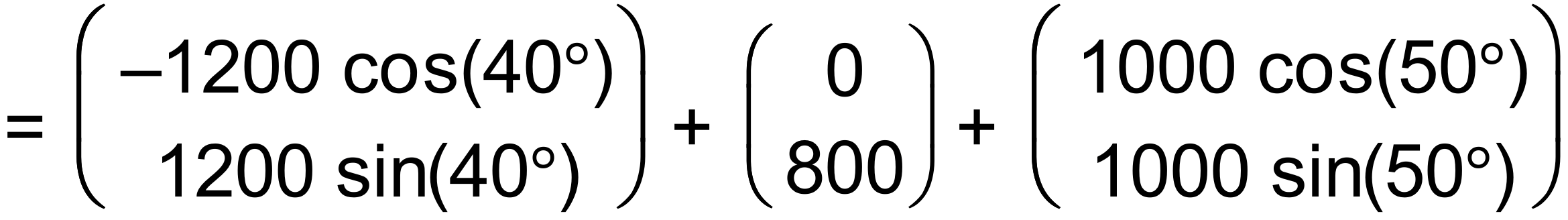
13. (a)



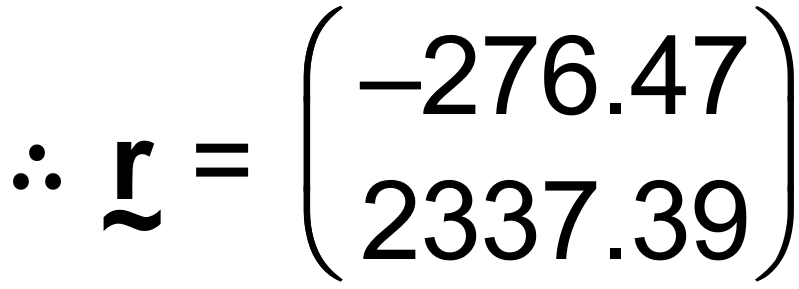
Combined force vector:



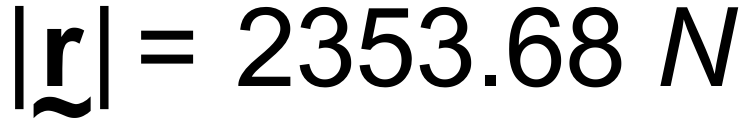
✔✔✔



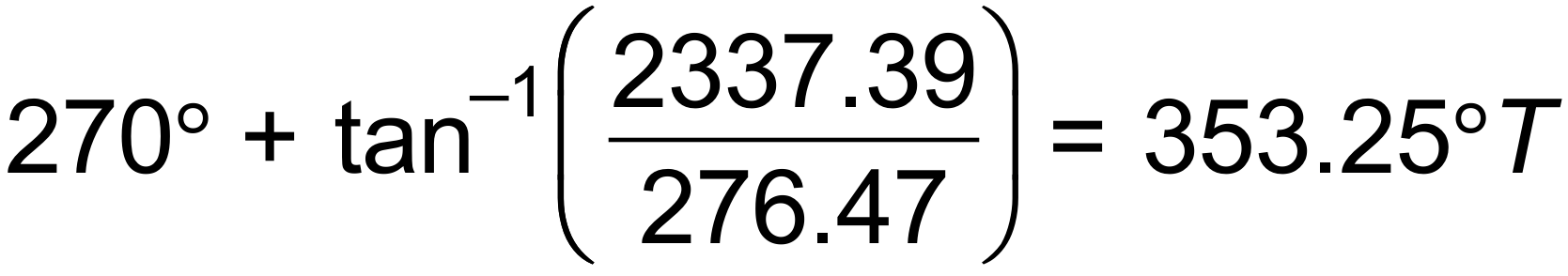
✔



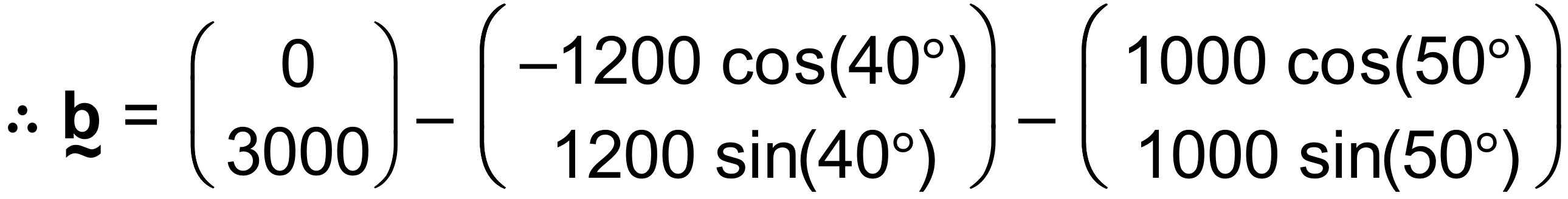
and ✔



bearing = ✔



13. (b) ✔



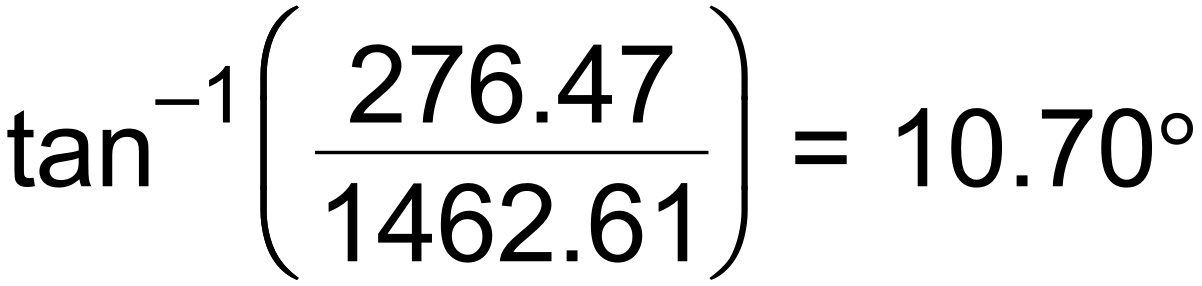
✔



maximum force = ✔

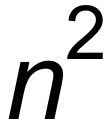


bearing =

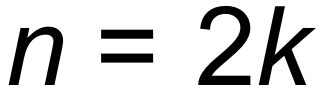


∴ 79.30°T ✔ [10]

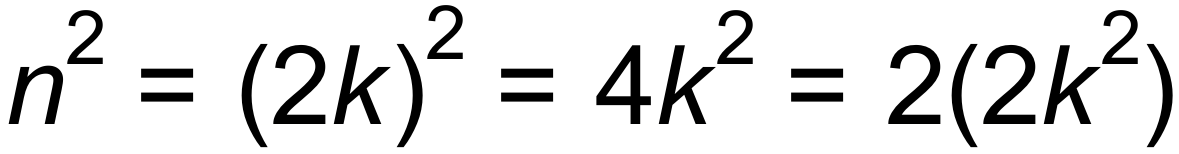
14. (a) Assume that *n* is even and is odd. ✔



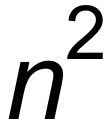
Then such that ✔



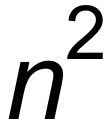
Thus,



which implies that must be even. ✔



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



and therefore *n* must be even.

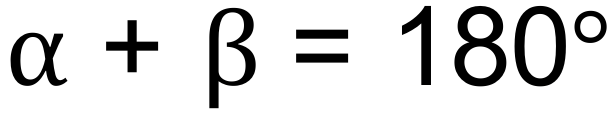
(b) ✔



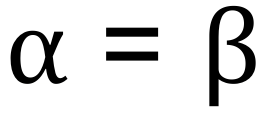
✔



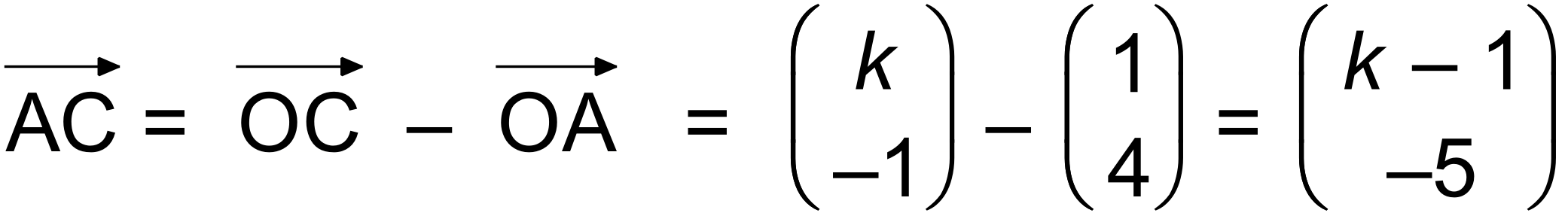
and hence as required ✔



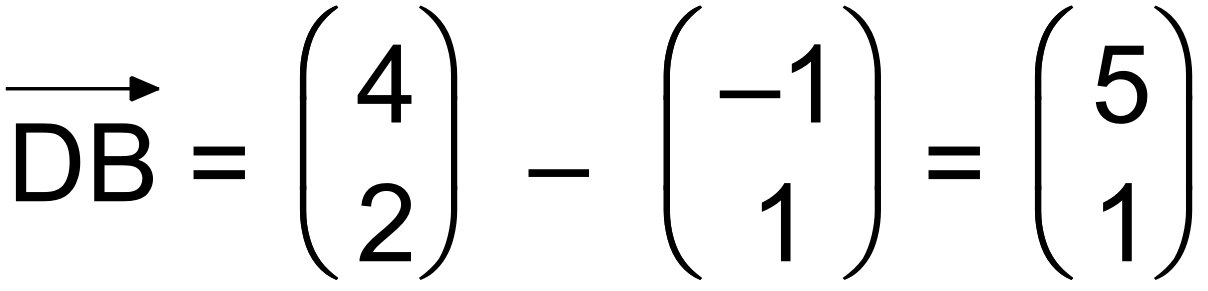
if O,B,D are collinear OR DB=diameter ✔ [8]



15. (a) ✔



✔

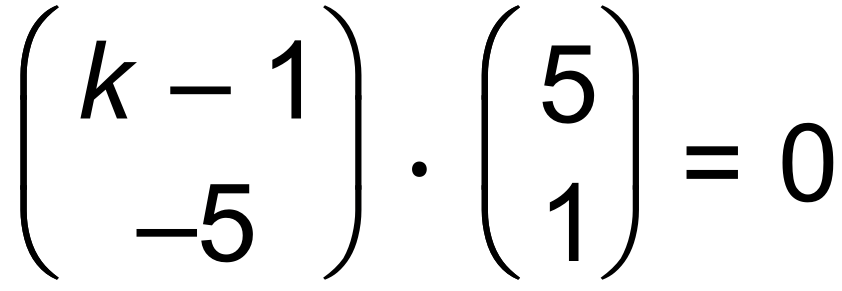


(b) In a rhombus the diagonals are perpendicular.

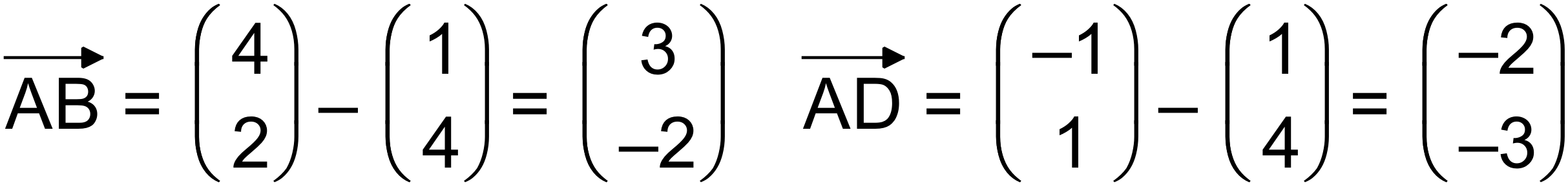
✔



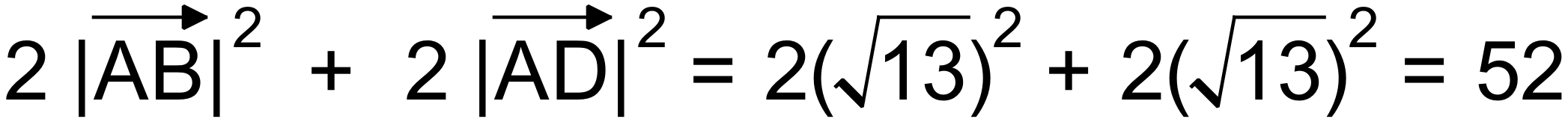
hence ✔



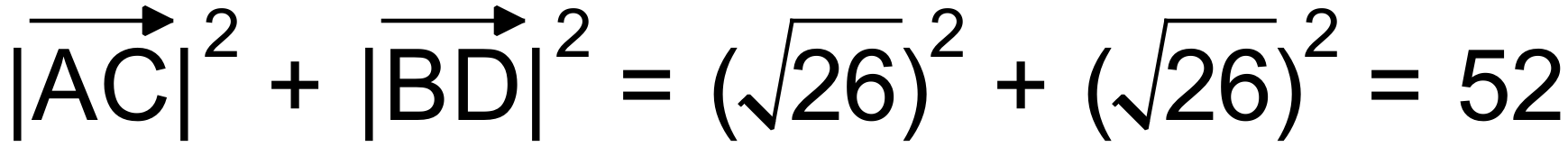
(c) ✔



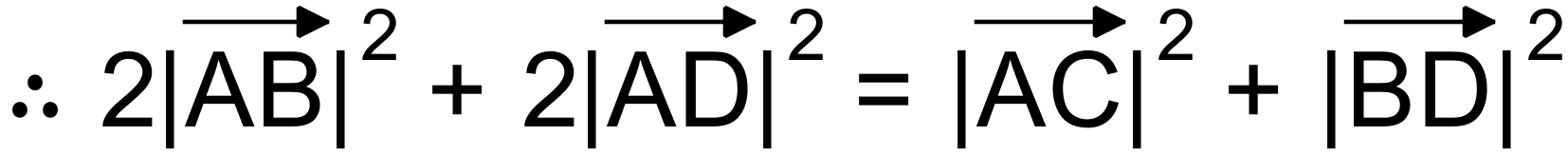
✔



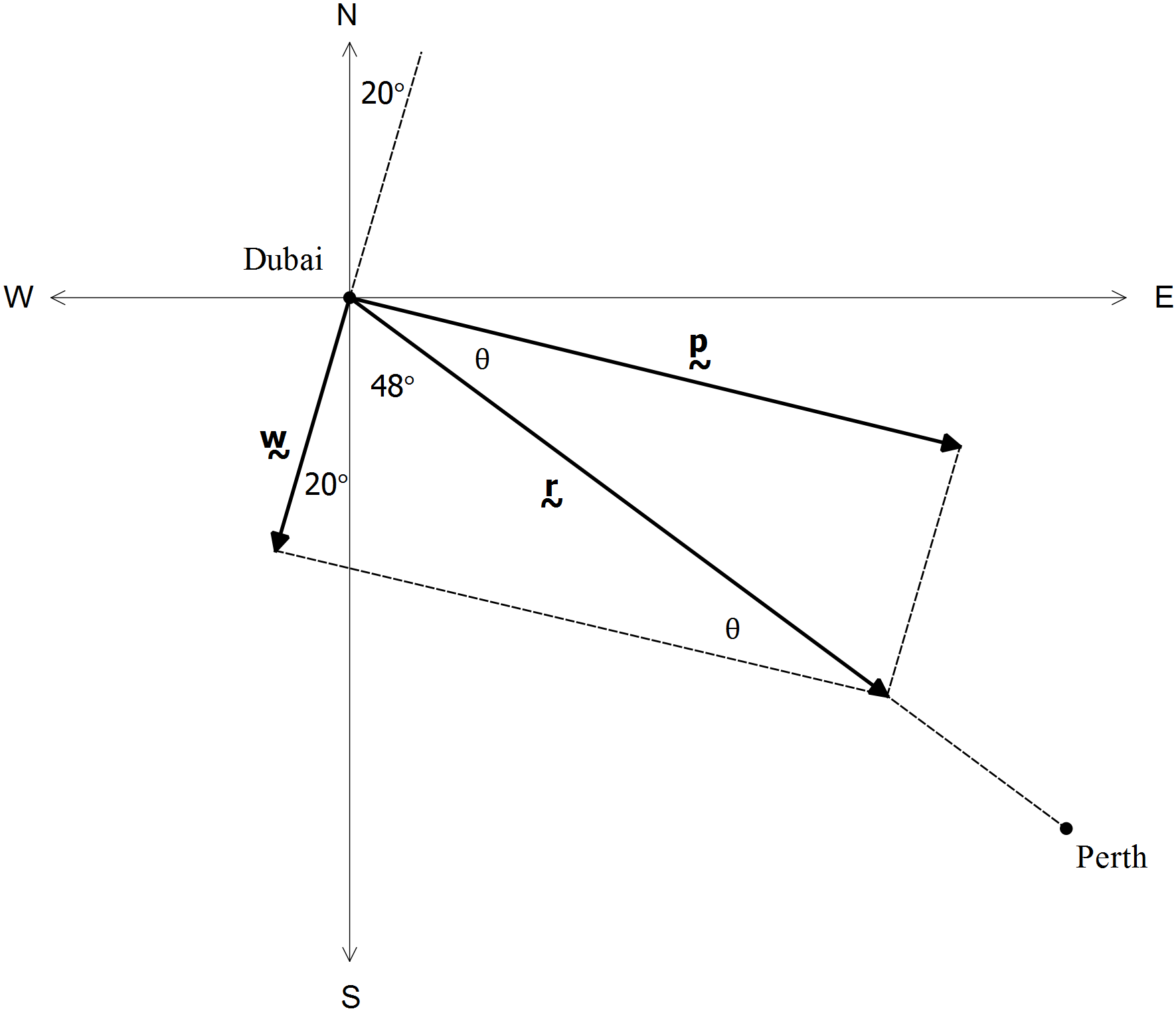
✔



as required. [7]

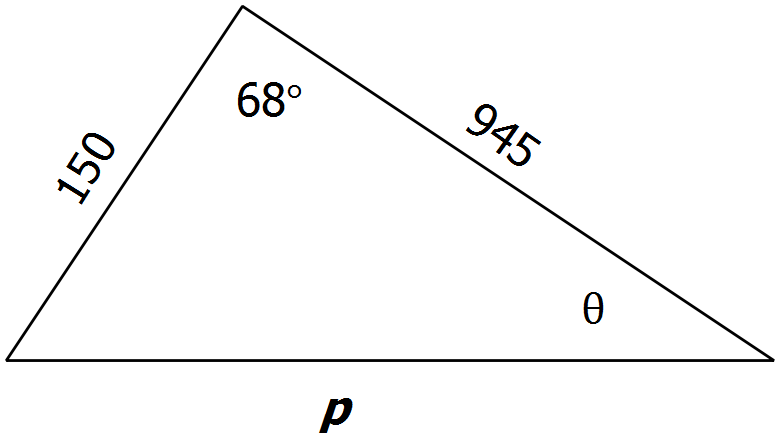


16. (a)



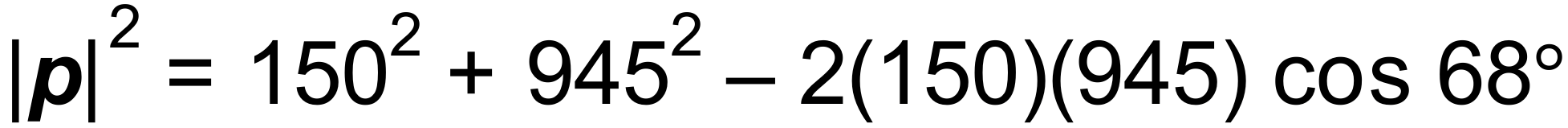


(b)

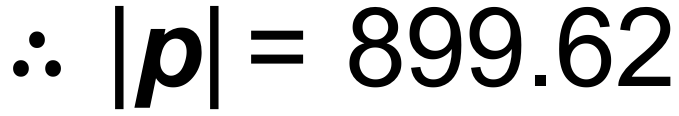




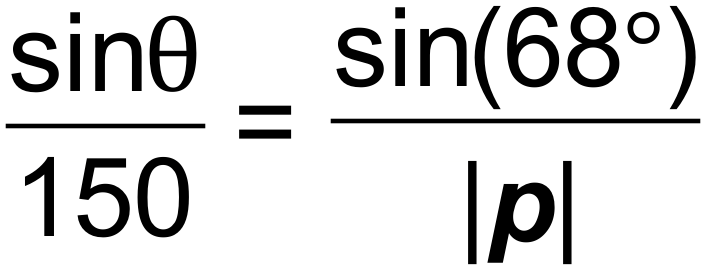
(c) ✔



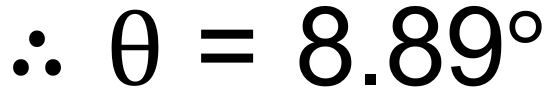
km/h ✔



✔

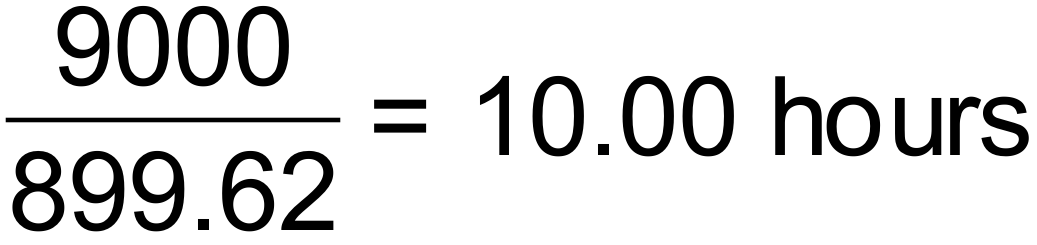


✔

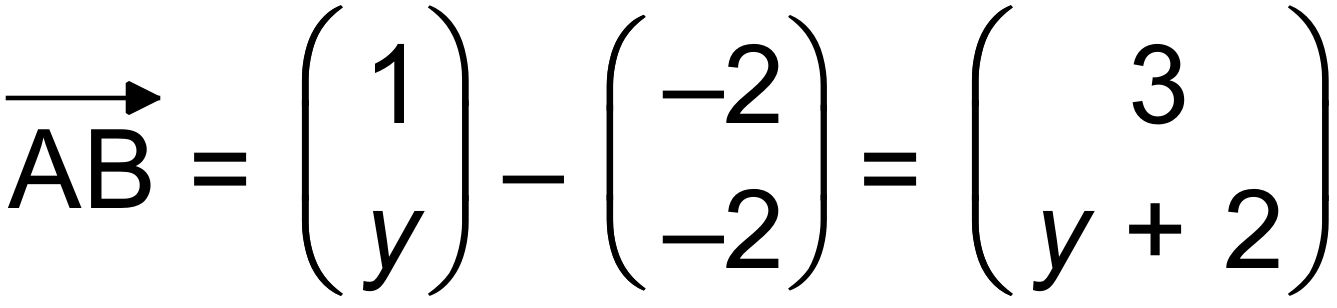


Hence, bearing = 132°– 8.89° = 123.11°T ✔

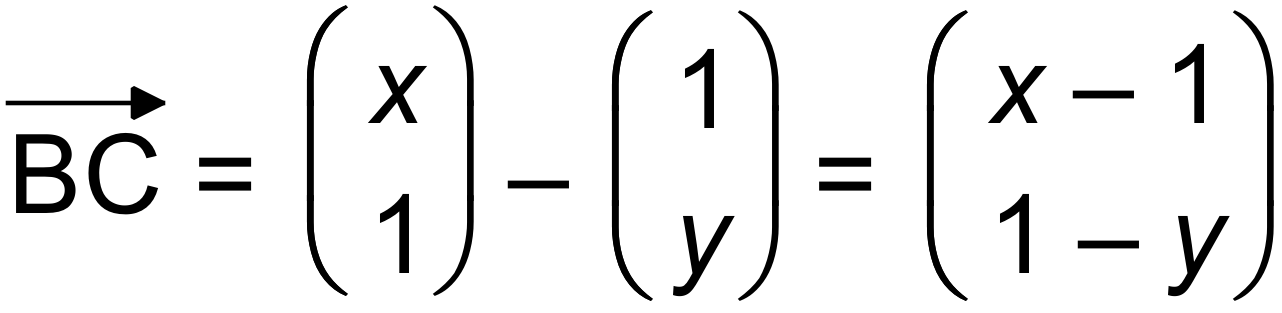
and flight duration = ✔ [11]



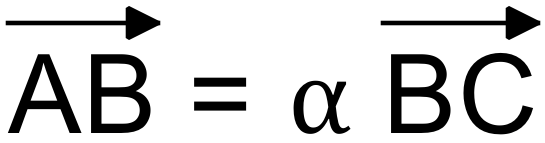
17. ✔



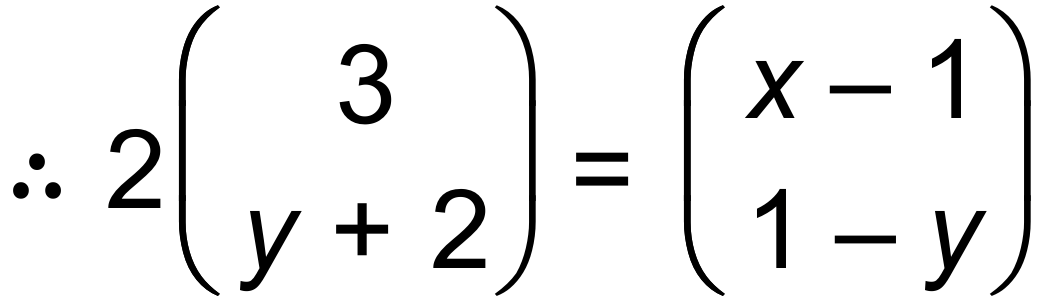
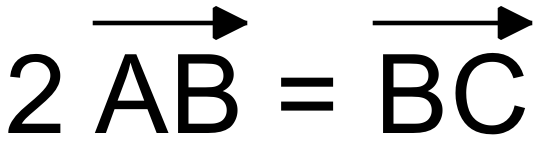
✔



since A,B,C collinear then ✔



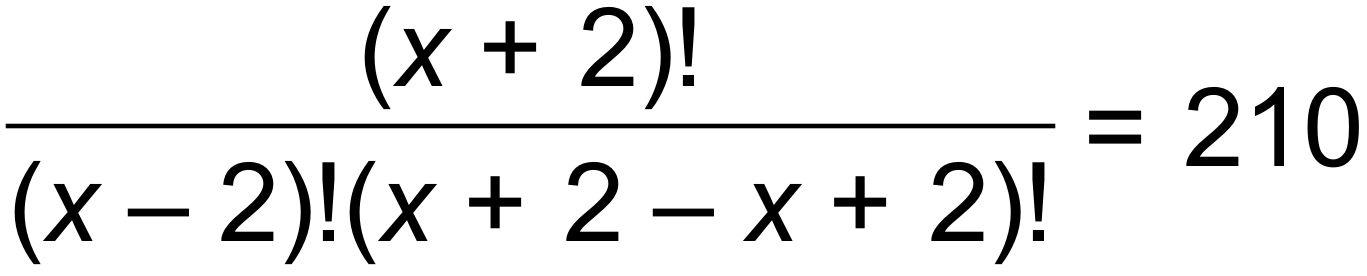
Given AB:BC = 1:2 then ✔



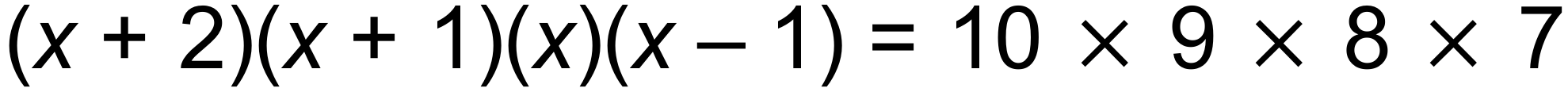
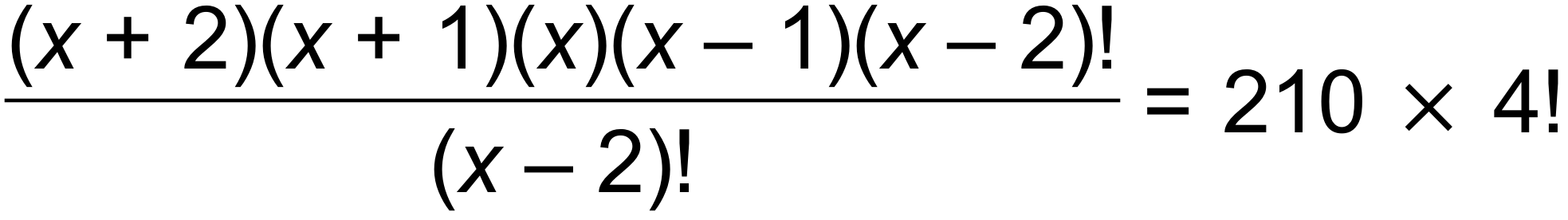
✔✔ [6]



18. (a) ✔



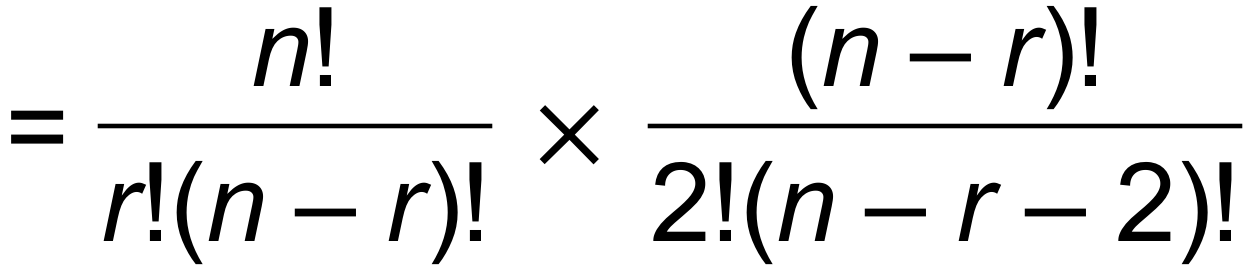
✔



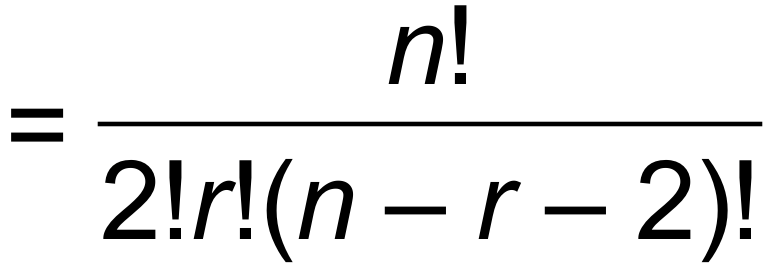
✔



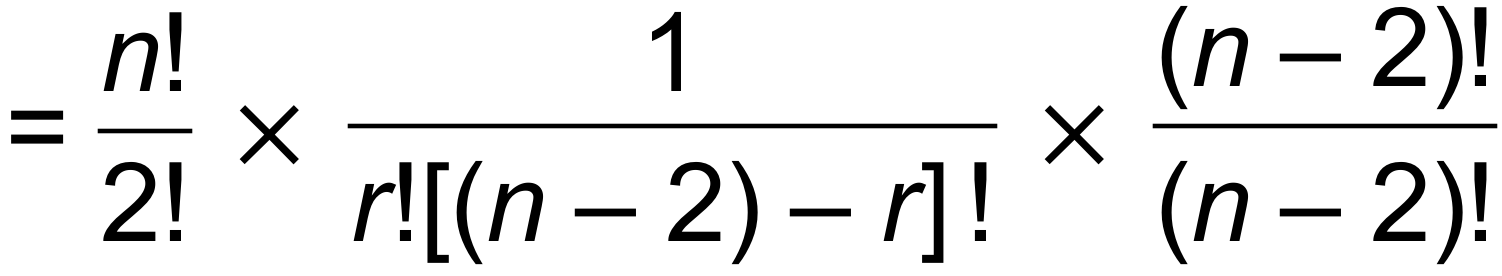
(b) LHS ✔



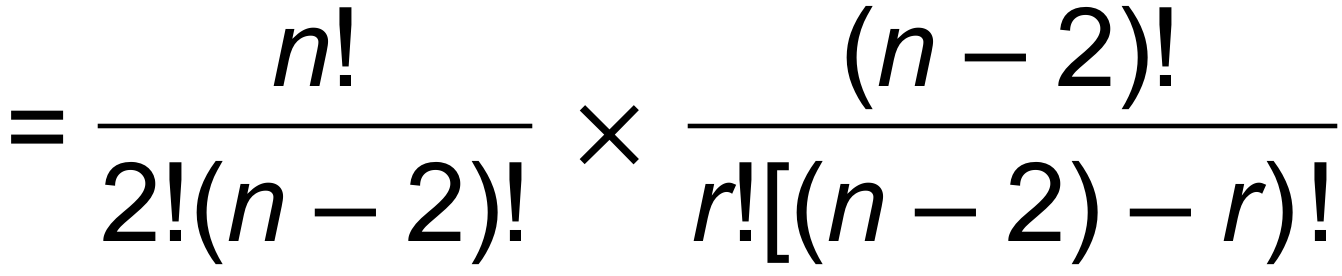
✔



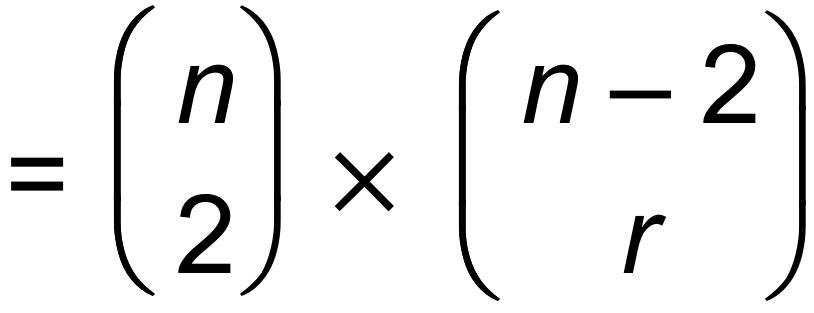
✔



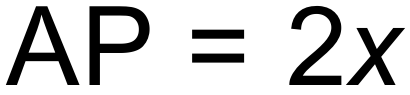
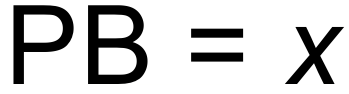
✔



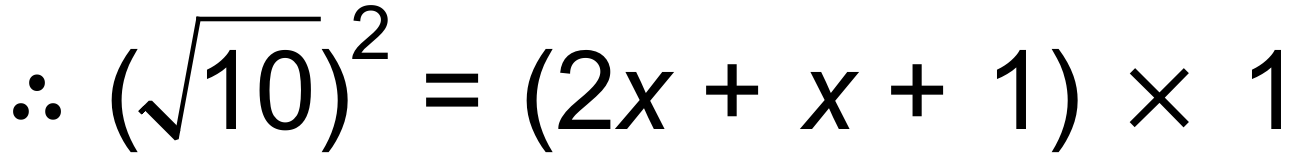
= RHS [7]



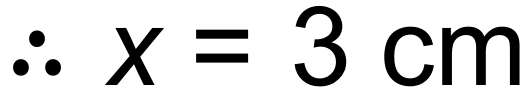
19. (a) Let and



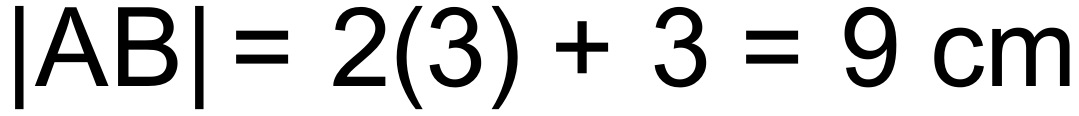
✔



✔



and hence ✔



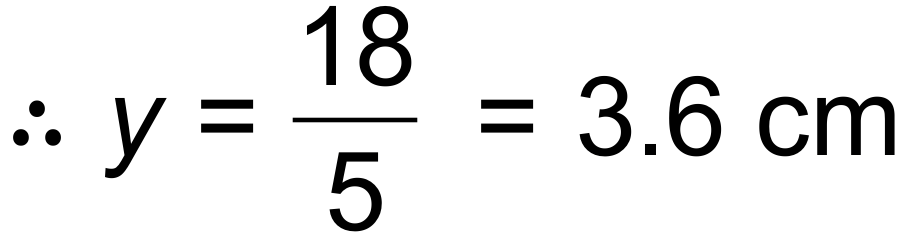
(b)



✔



✔



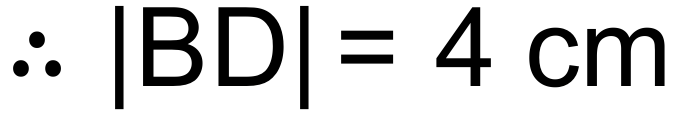
and hence ✔



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

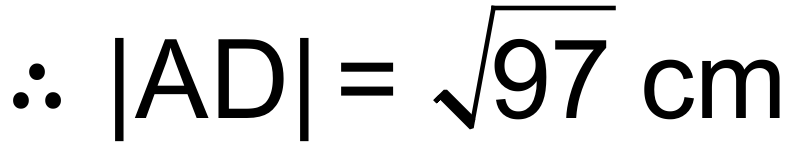
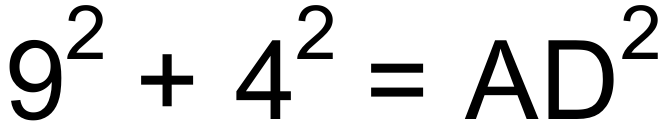


✔



(d) ∆ABD is right angled in semicircle

✔



hence, radius is ✔ [9]

