Natural language theorem statement

Mathd_algebra_141. For real numbers a, b, if $a \cdot b = 180$, and $2(a+b) = 54$. Prove that: $a^2 + b^2 = 369$

Formal theorem statement

```
theorem Mathd_algebra_141
  (a b : ℝ)
  (h₁ : (a * b)=180)
  (h₂ : 2 * (a + b)=54) :
  (a^2 + b^2) = 369 :=
  sorry
```

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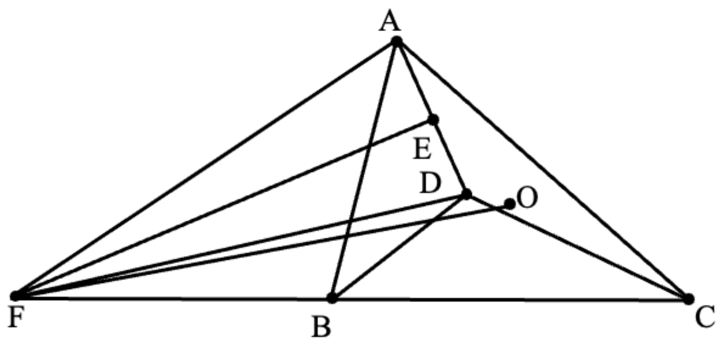
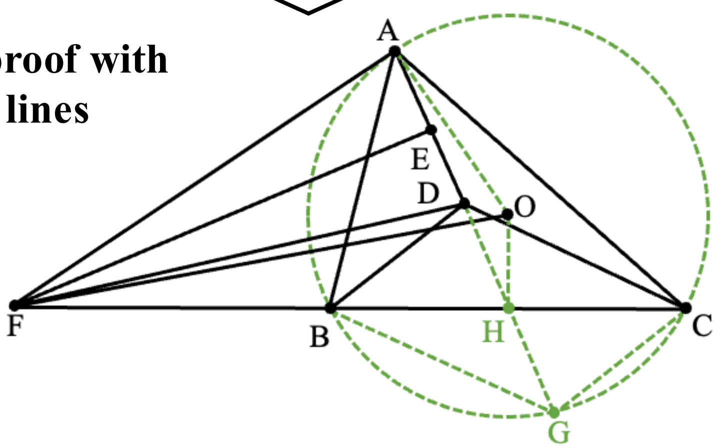
Natural language statement with image

USAMO_2008. In the figure, O is the circumcenter of △ABC, ∠DAB = ∠DBC and ∠DAC = ∠DCB. E is the midpoint of AD, and EF is drawn perpendicular to AD. Prove that ∠AFD = 2∠OFC.



Human proof with auxiliary lines



Formal theorem statement in multi-language

```
variables (A B C D E F O : ℝ × ℝ)
-- (From diagram) All points lie in the same plane (coplanarity)
axiom all_points_coplanar : AffineIndependent ℝ ![A, B, C, D, E, F, O]
-- (From statement)
axiom O_is_circumcenter : IsCircumcenter O A B C
axiom angle_eq_1 : ∠ D A B = ∠ D B C
axiom angle_eq_2 : ∠ D A C = ∠ D C B
axiom E_is_midpoint : E = midpoint ℝ A D
axiom EF_perp_AD : ⊥ (E − F) (A − D)
-- (From diagram) F on extended line BC
axiom F_on_BC : Collinear ℝ ({F, B, C} : Set (ℝ × ℝ)) ∧ (¬Between ℝ F B C)
-- (From diagram) points are distinct and non-collinear
axiom angle_AFD:  A ≠ F ∧ D ≠ F ∧ ¬Collinear ℝ ({A, F, D} : Set (ℝ × ℝ))
-- (From diagram) points are distinct and non-collinear
axiom angle_OFC:  O ≠ F ∧ C ≠ F ∧ ¬Collinear ℝ ({O, F, C} : Set (ℝ × ℝ))
…
theorem USAMO_2008:
 ∠ A F D = 2 * ∠ O F C :=  sorry
```

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Isabelle

Coq