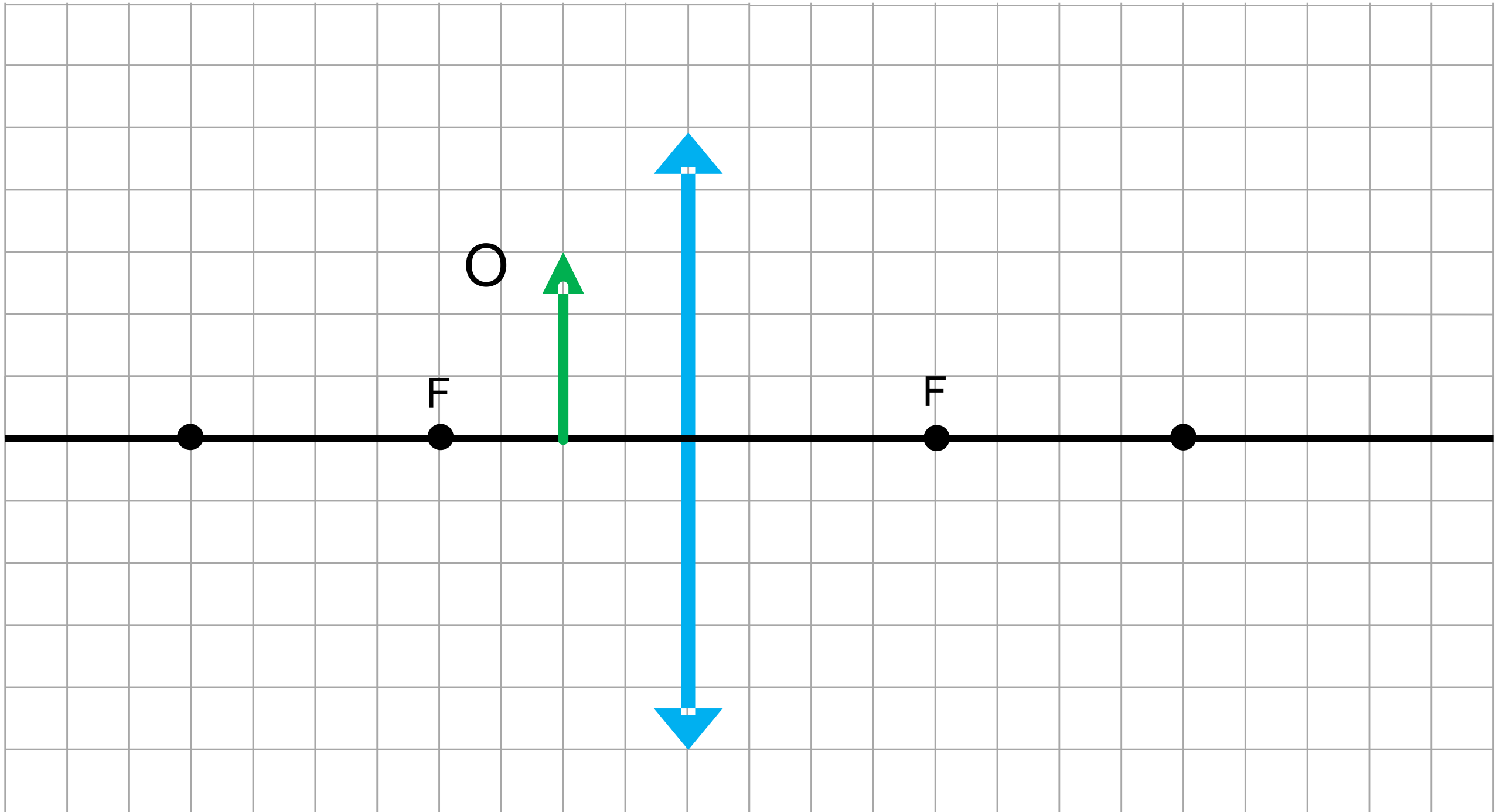
INSTRUMENTOS ÓTICOS
FÍSICA

Professor Danilo

Q. 12 - Lupa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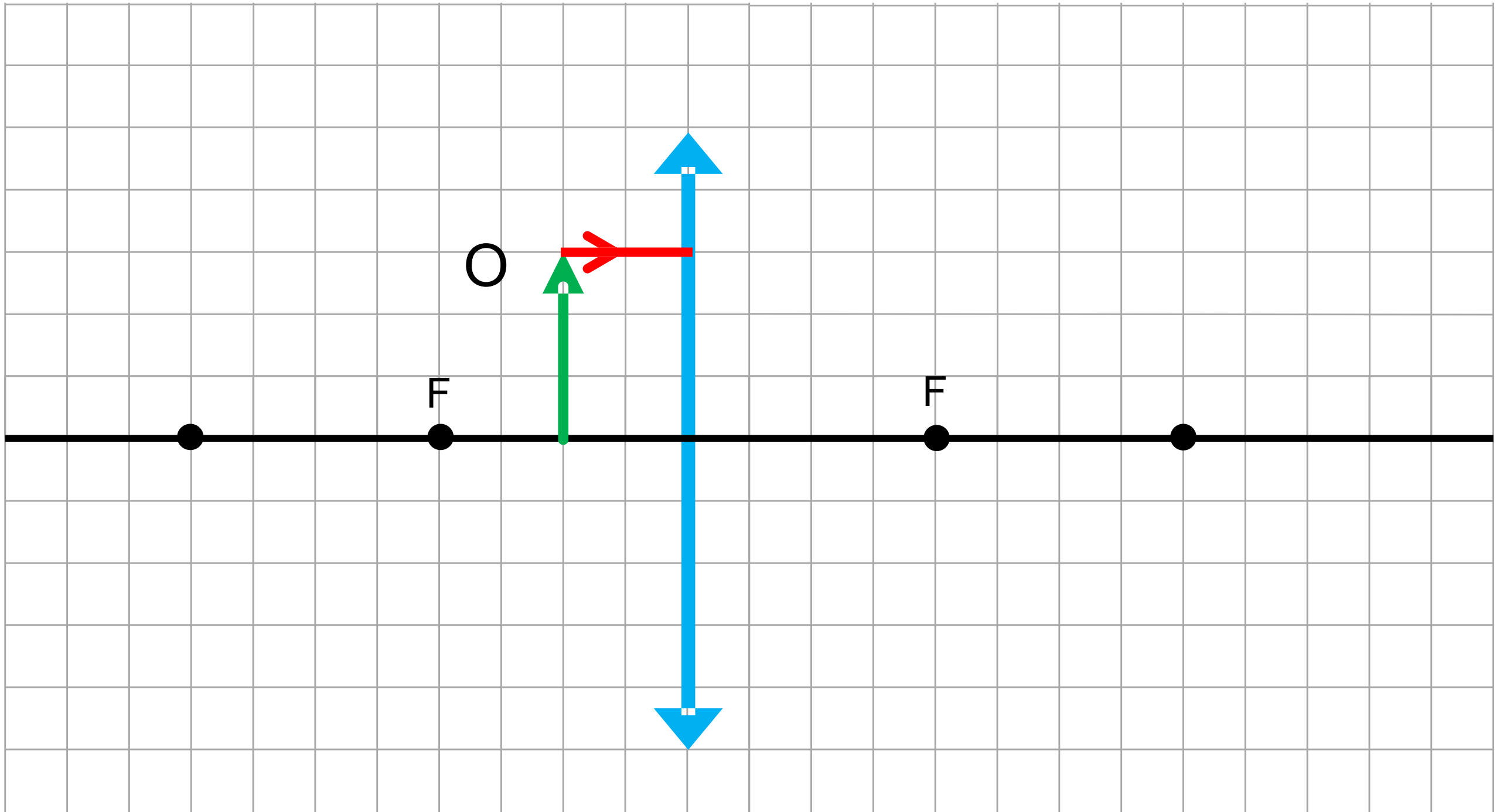
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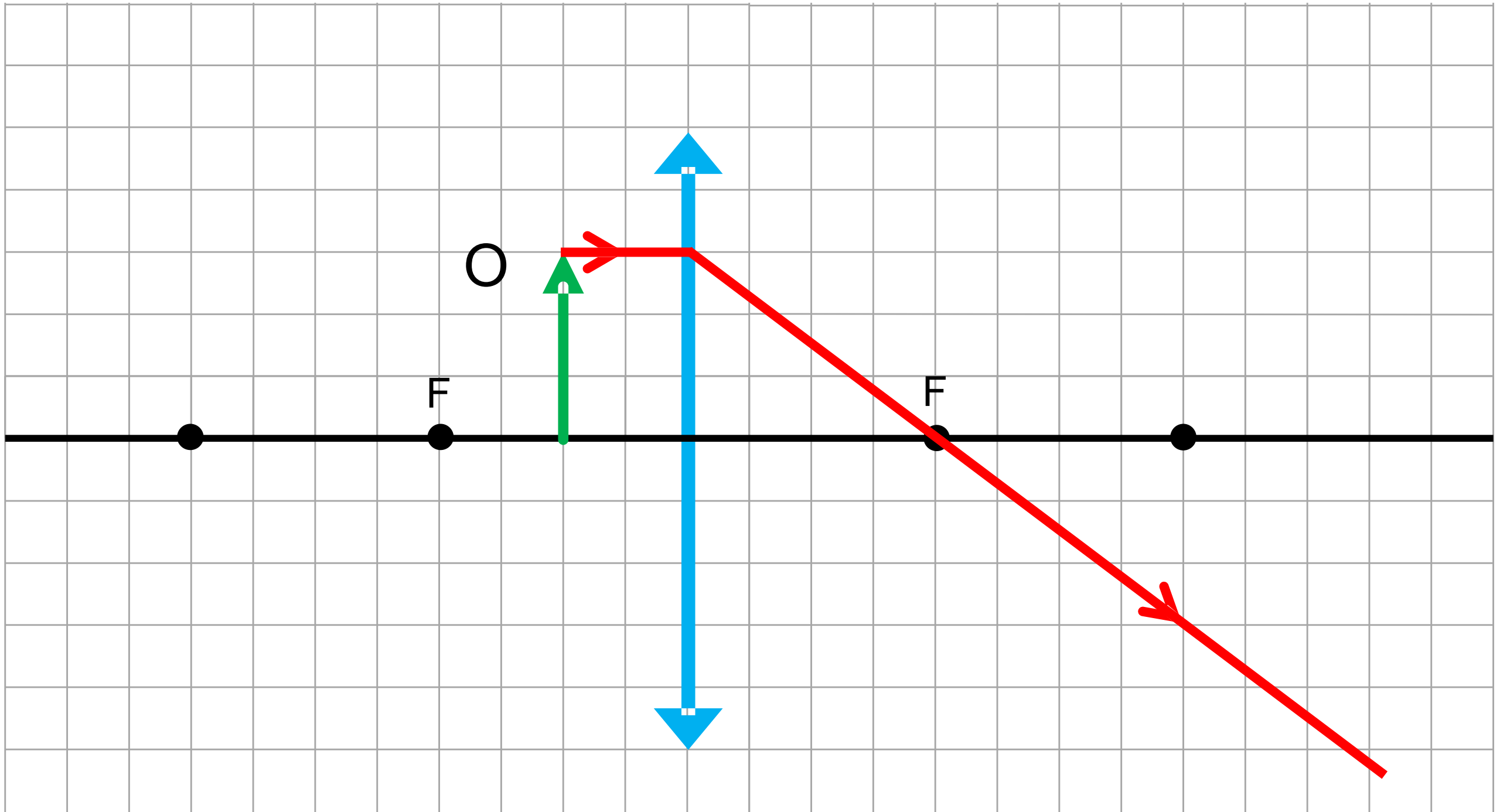
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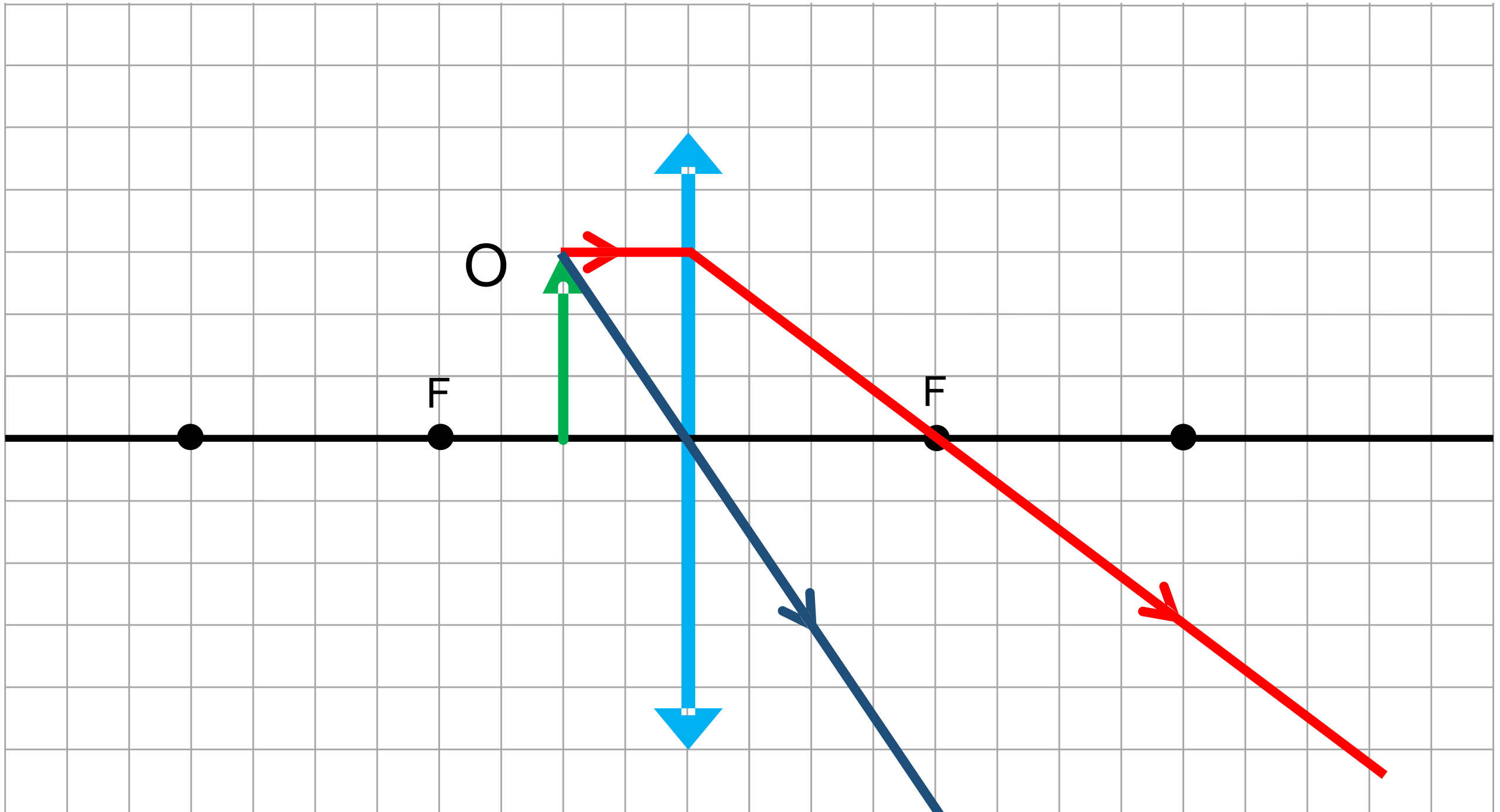
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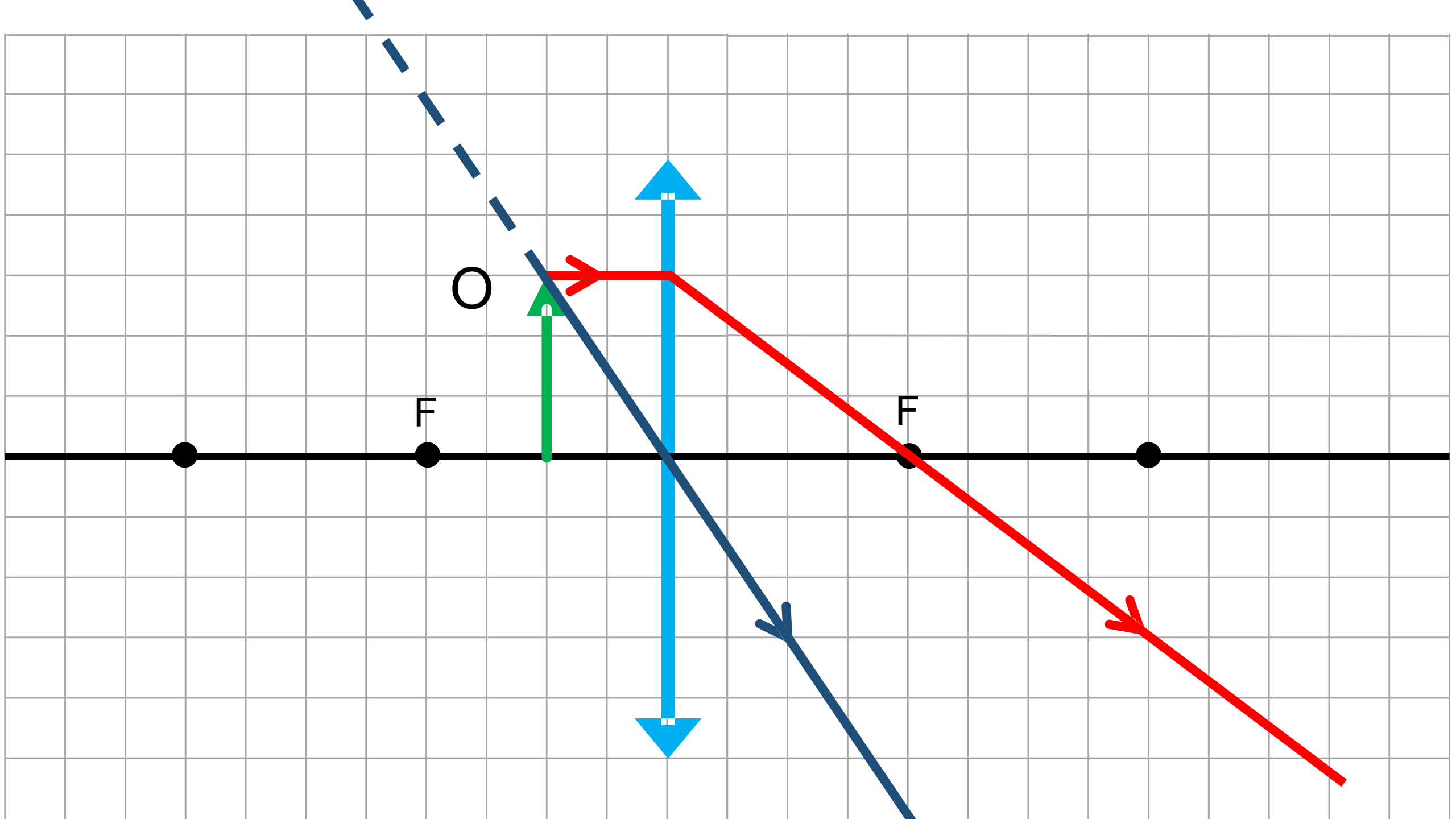
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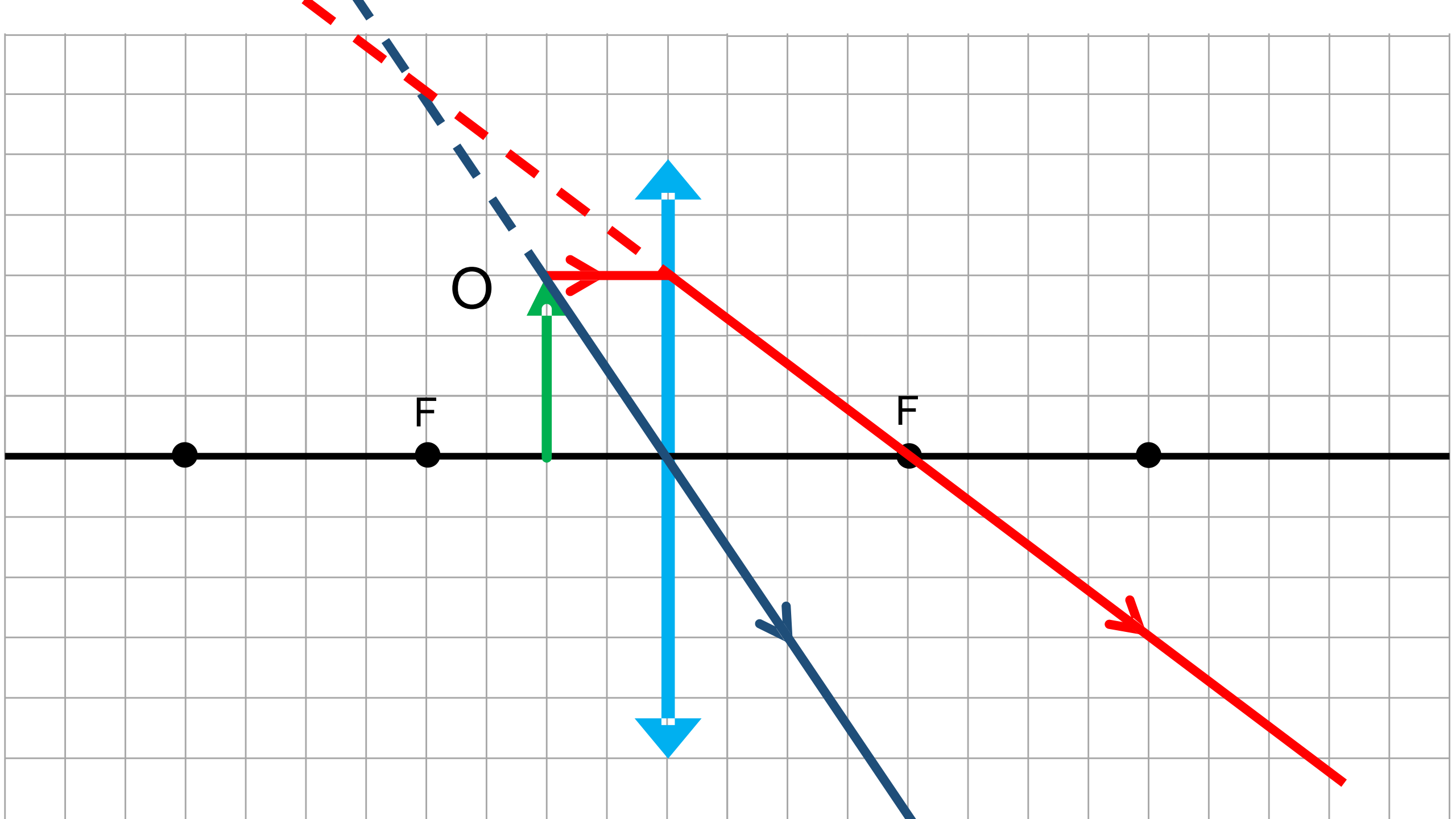
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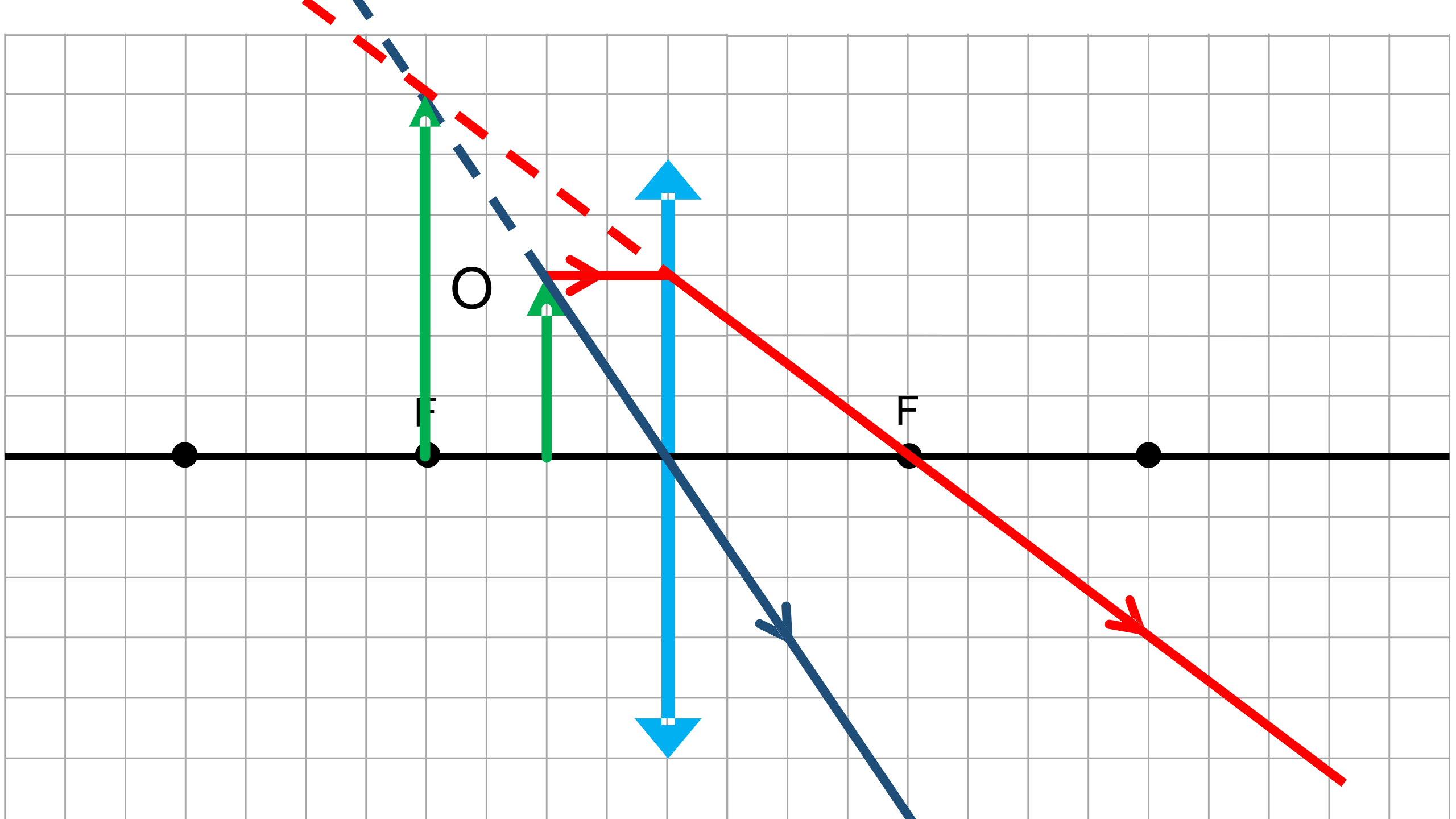

O
F
F

LUPA

LUPA

- IMAGEM:

LUPA

- IMAGEM:
  - VIRTUAL

LUPA

- IMAGEM:
  - VIRTUAL
  - DIREITA

LUPA

- IMAGEM:
  - VIRTUAL
  - DIREITA
  - MAIOR

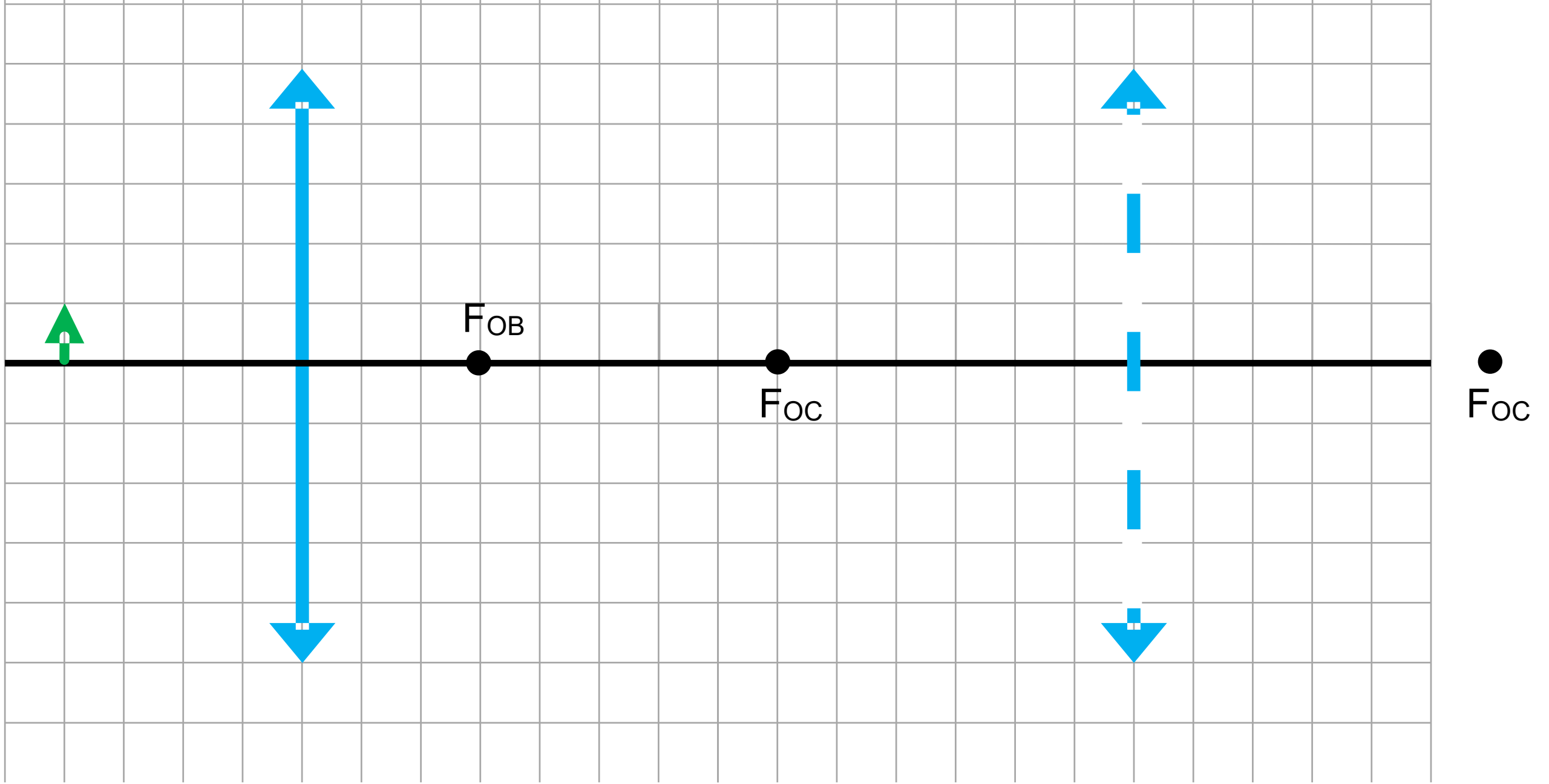
LUPA

- IMAGEM:
  - VIRTUAL
  - DIREITA
  - MAIOR
  - Mais distante da lente que o objeto

LUPA

- IMAGEM:
  - VIRTUAL
  - DIREITA
  - MAIOR
  - Mais distante da lente que o objeto
- Qualquer lente convergente pode servir como lupa

Q. 13 - MICROSCÓPIO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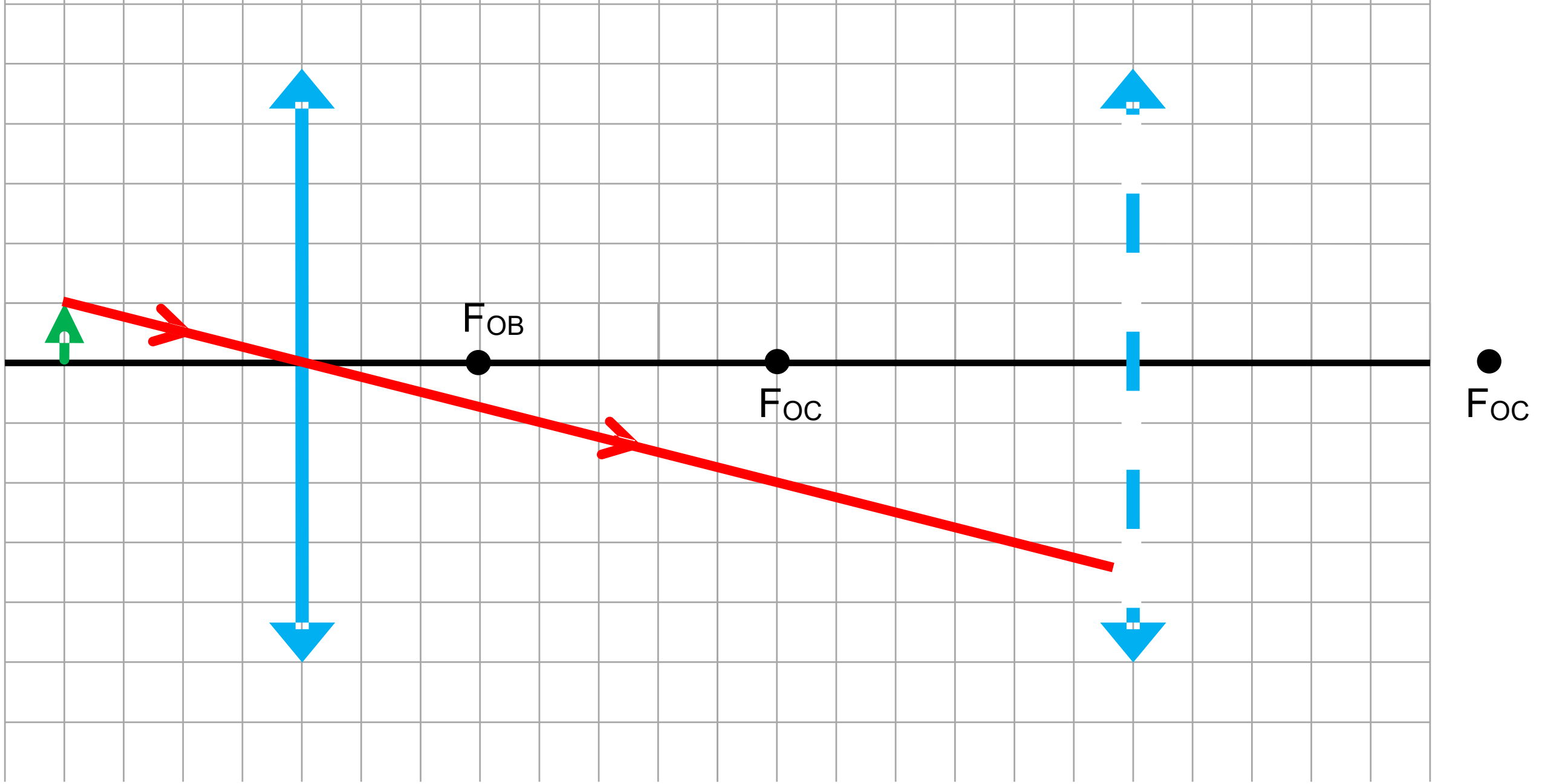
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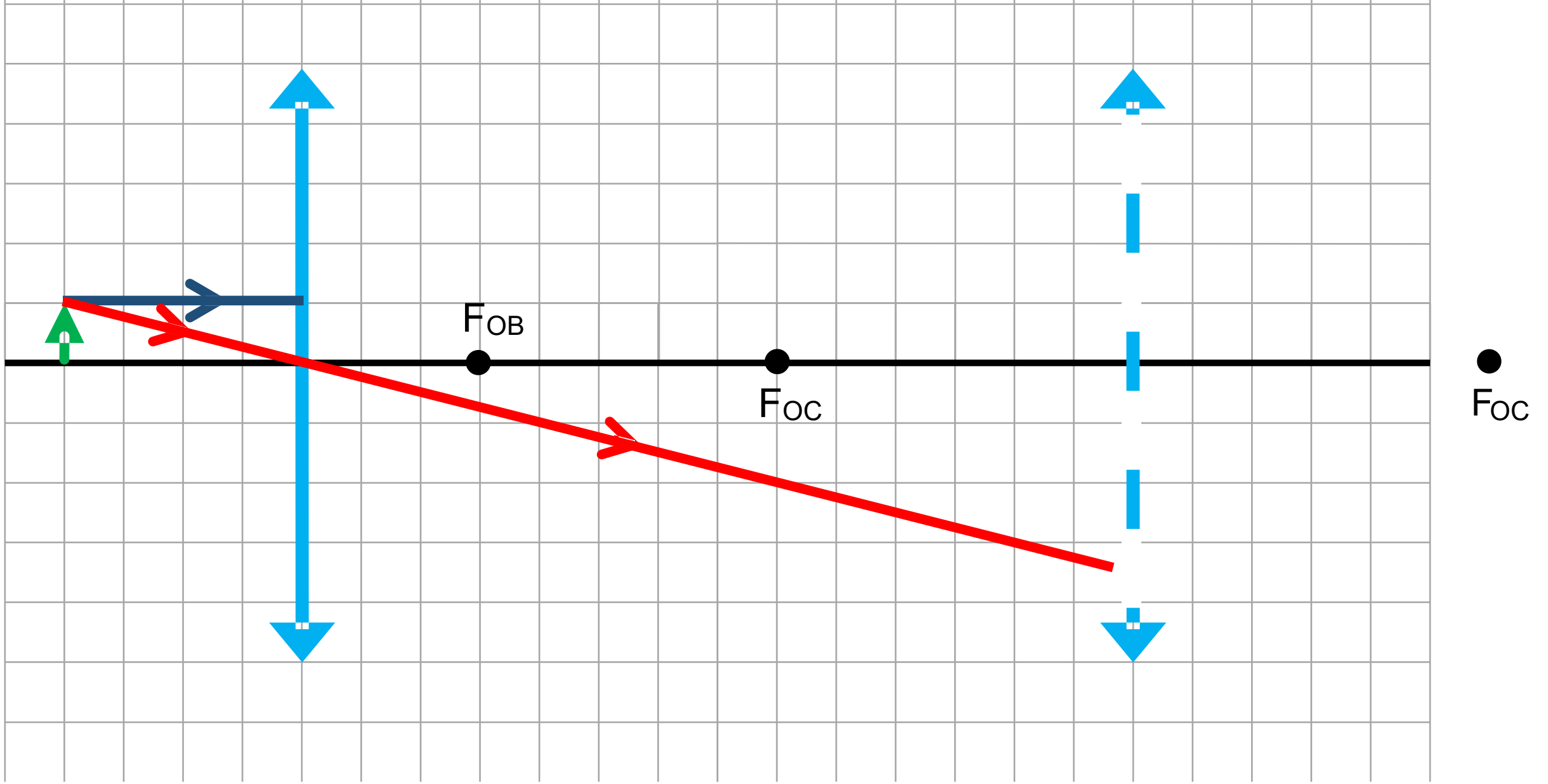
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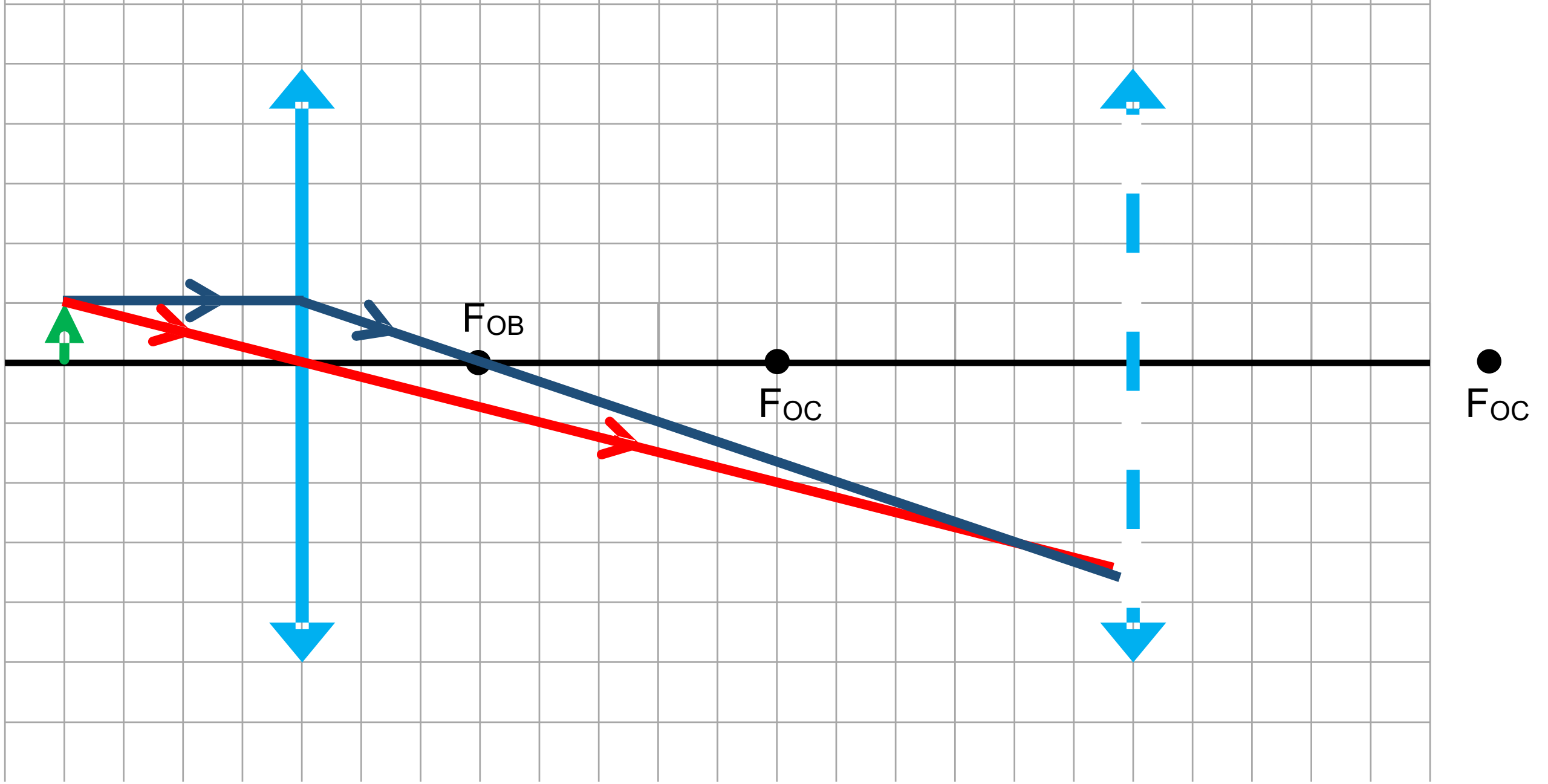
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FOC
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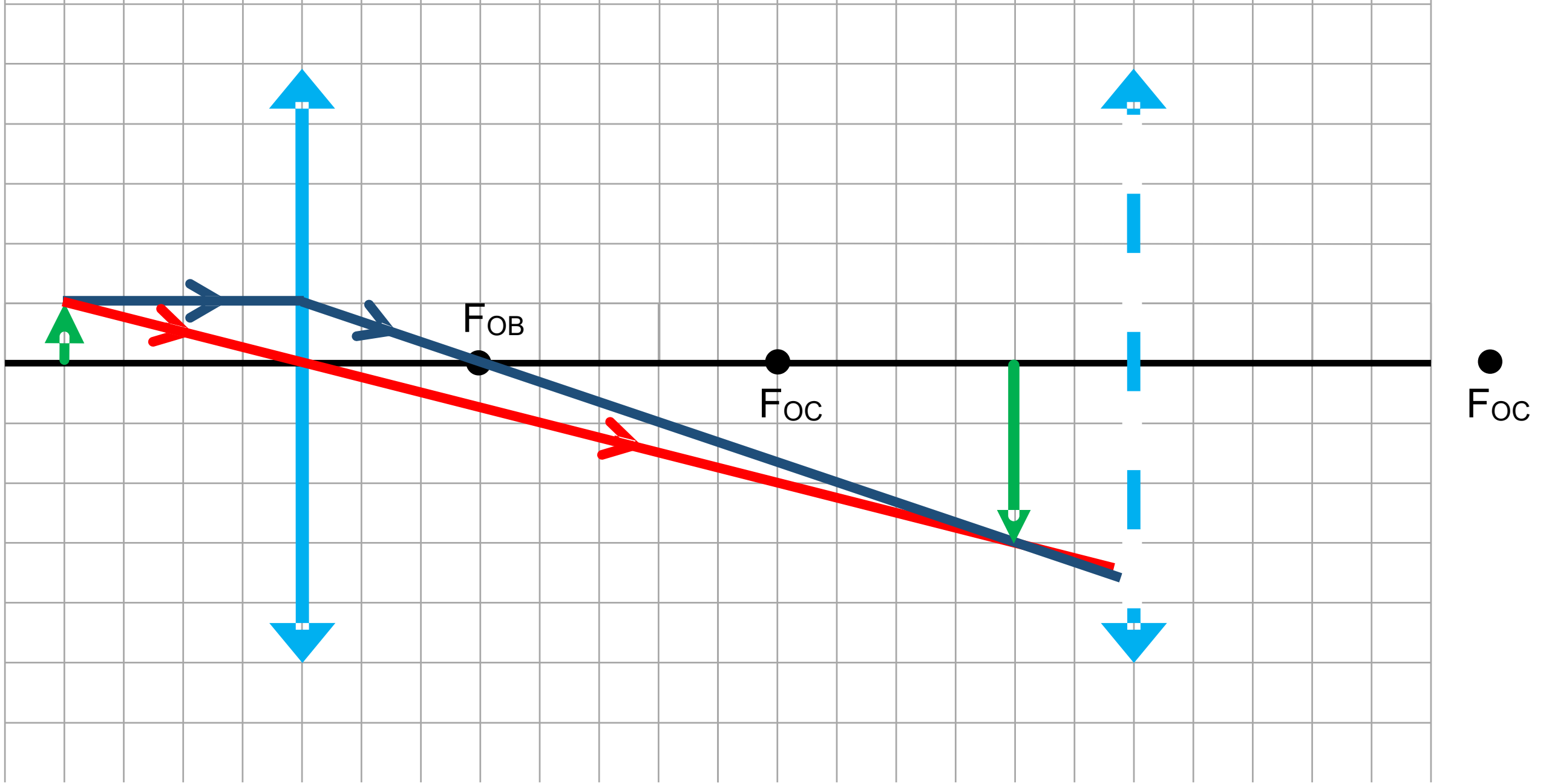
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FOC
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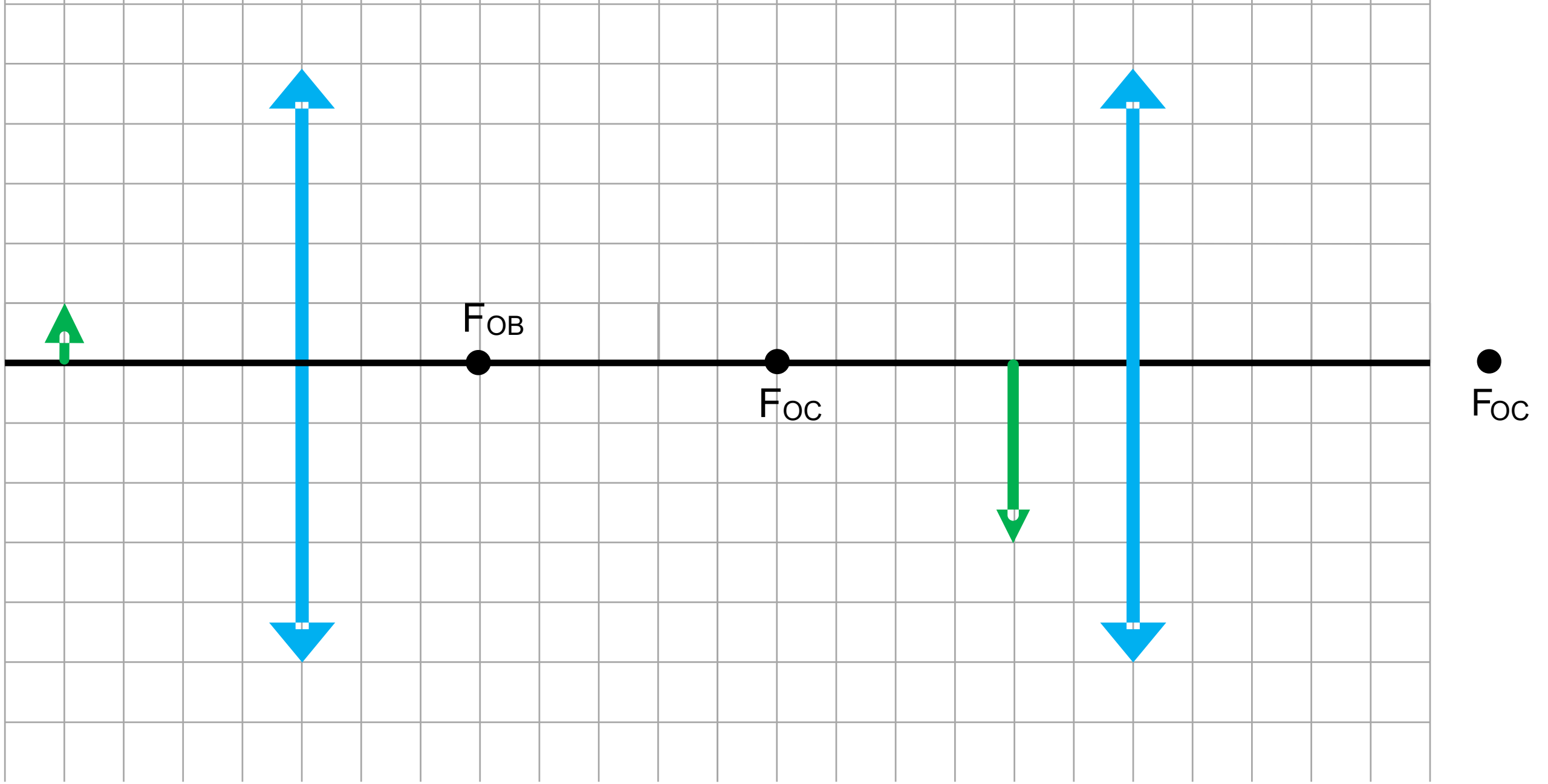
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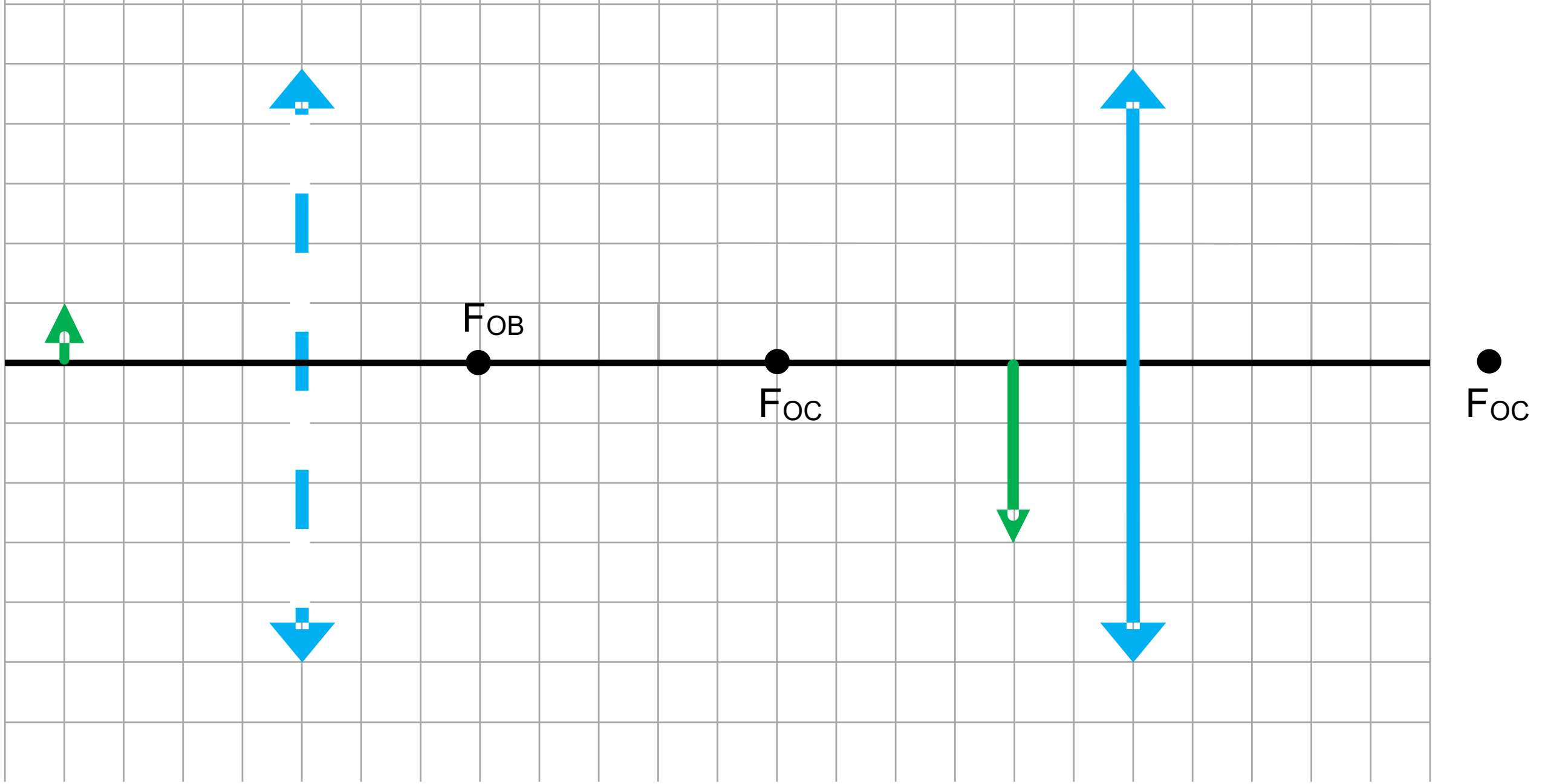
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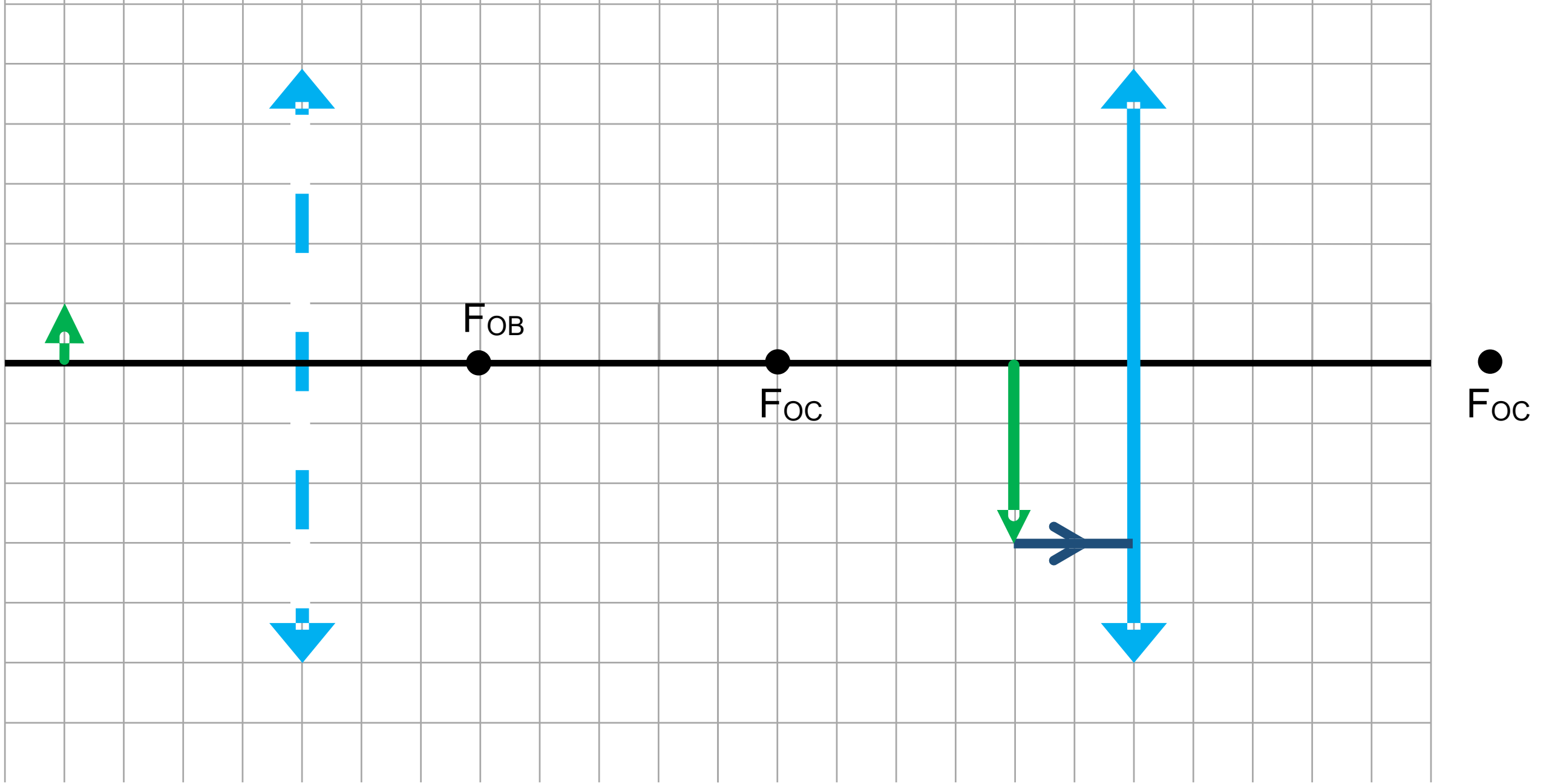
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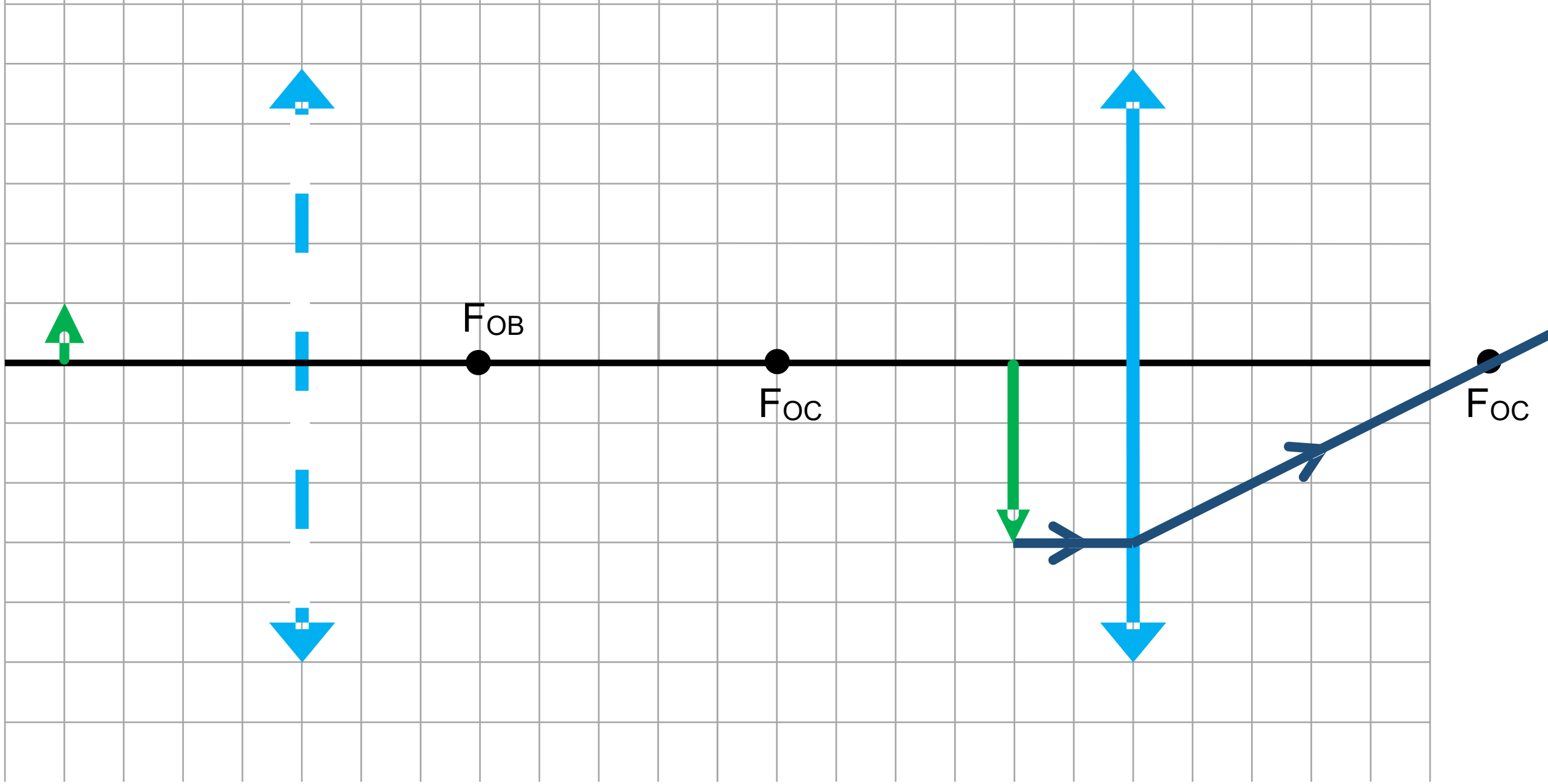
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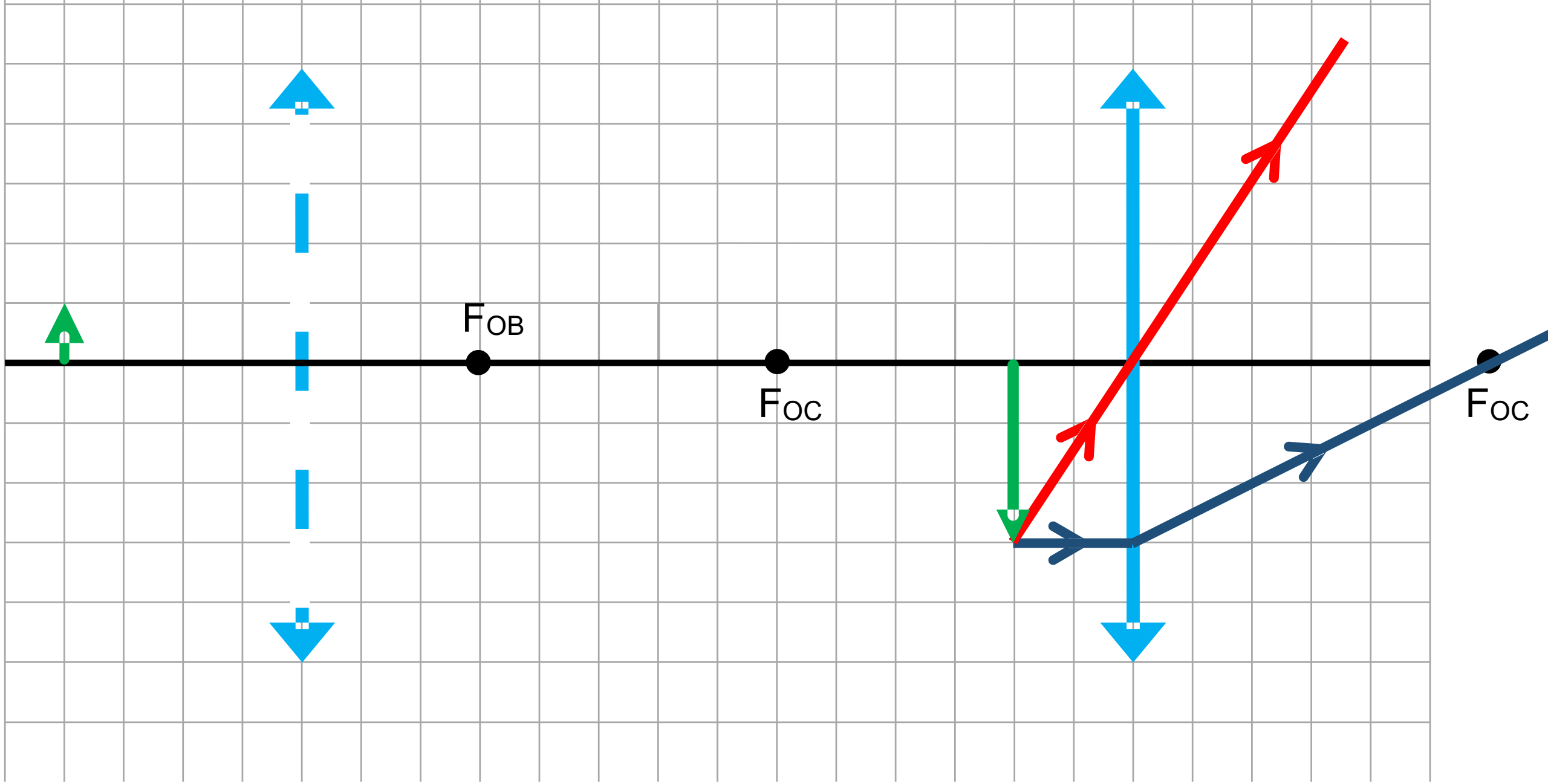
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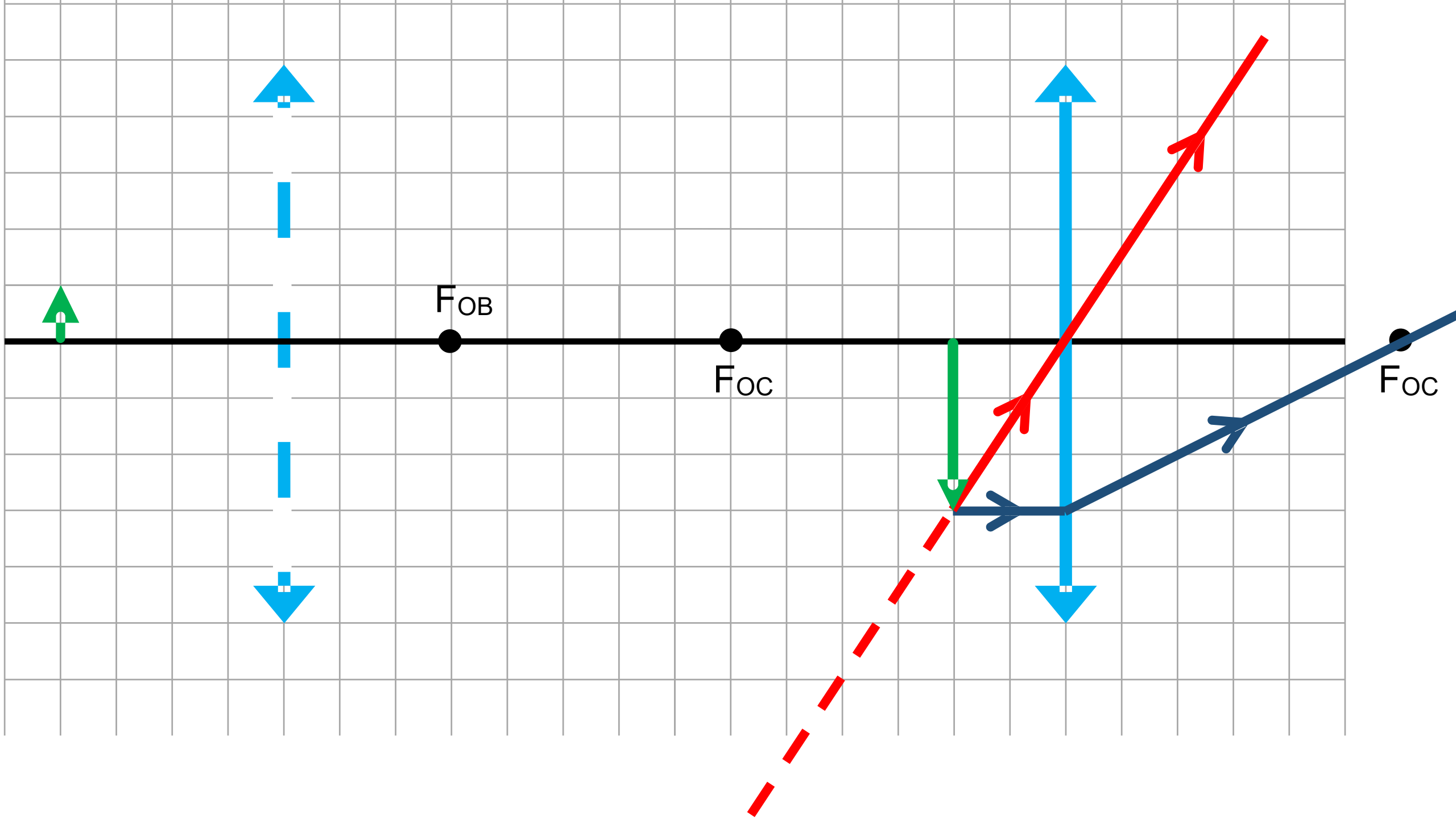
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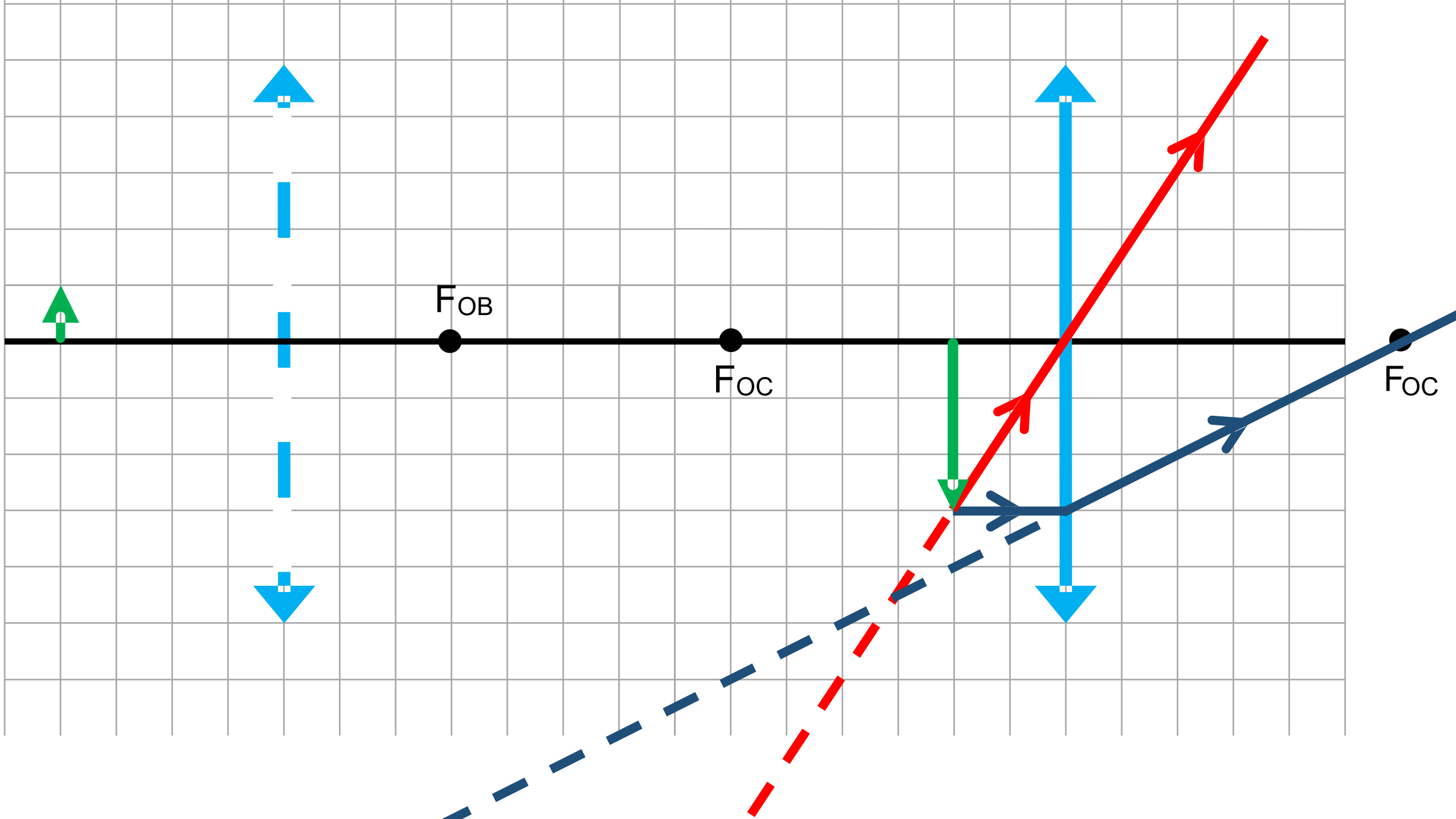
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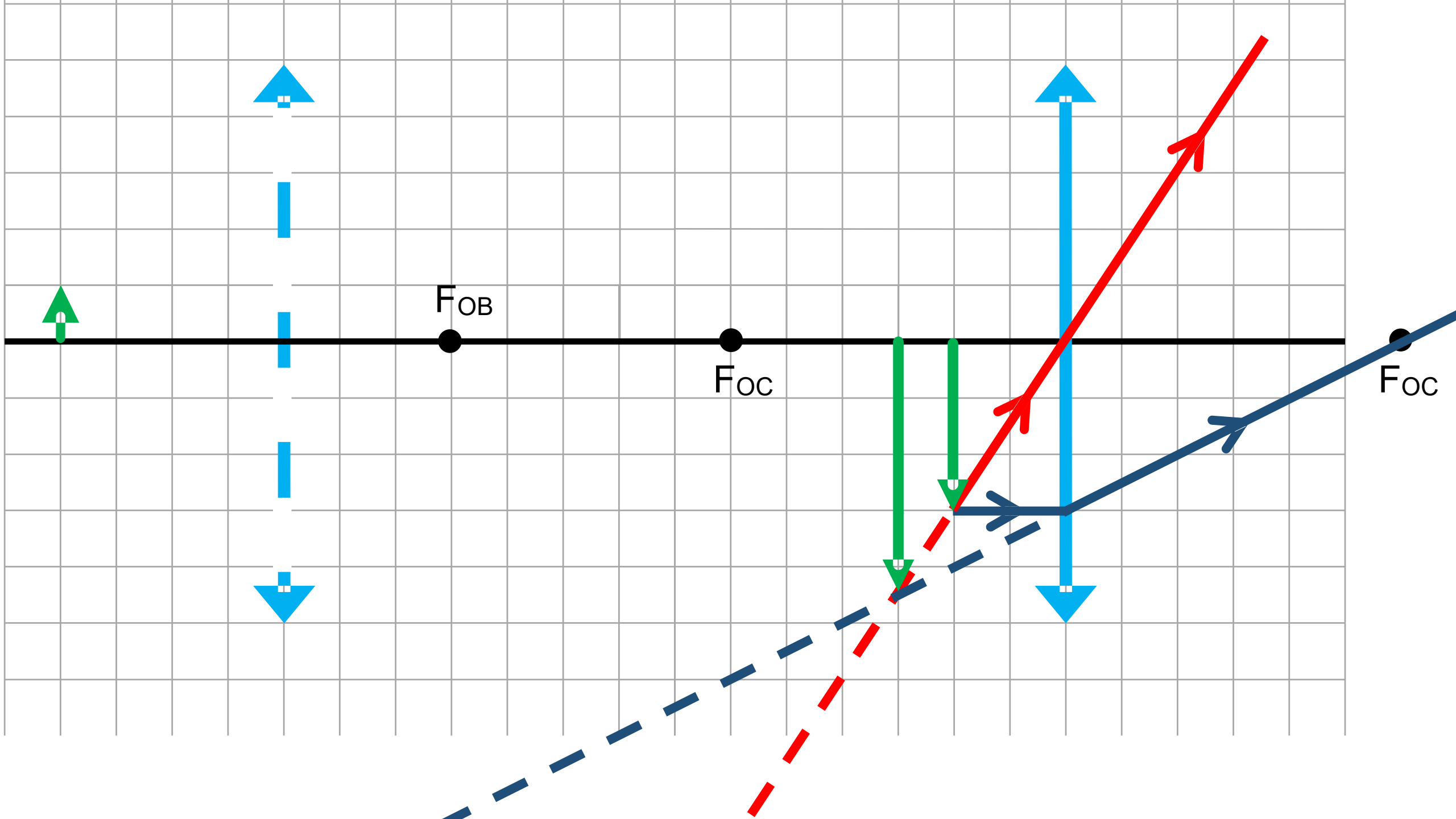
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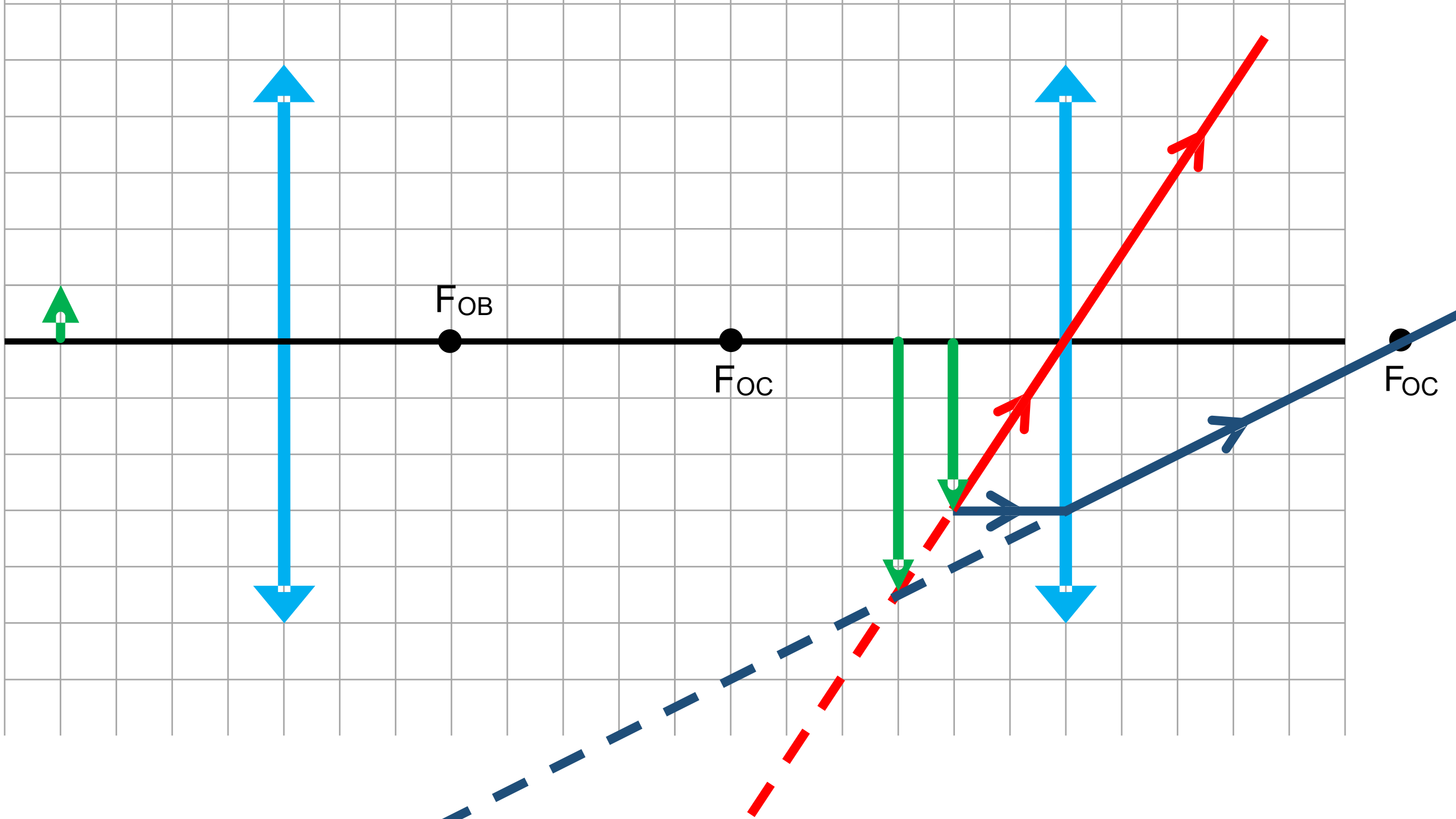
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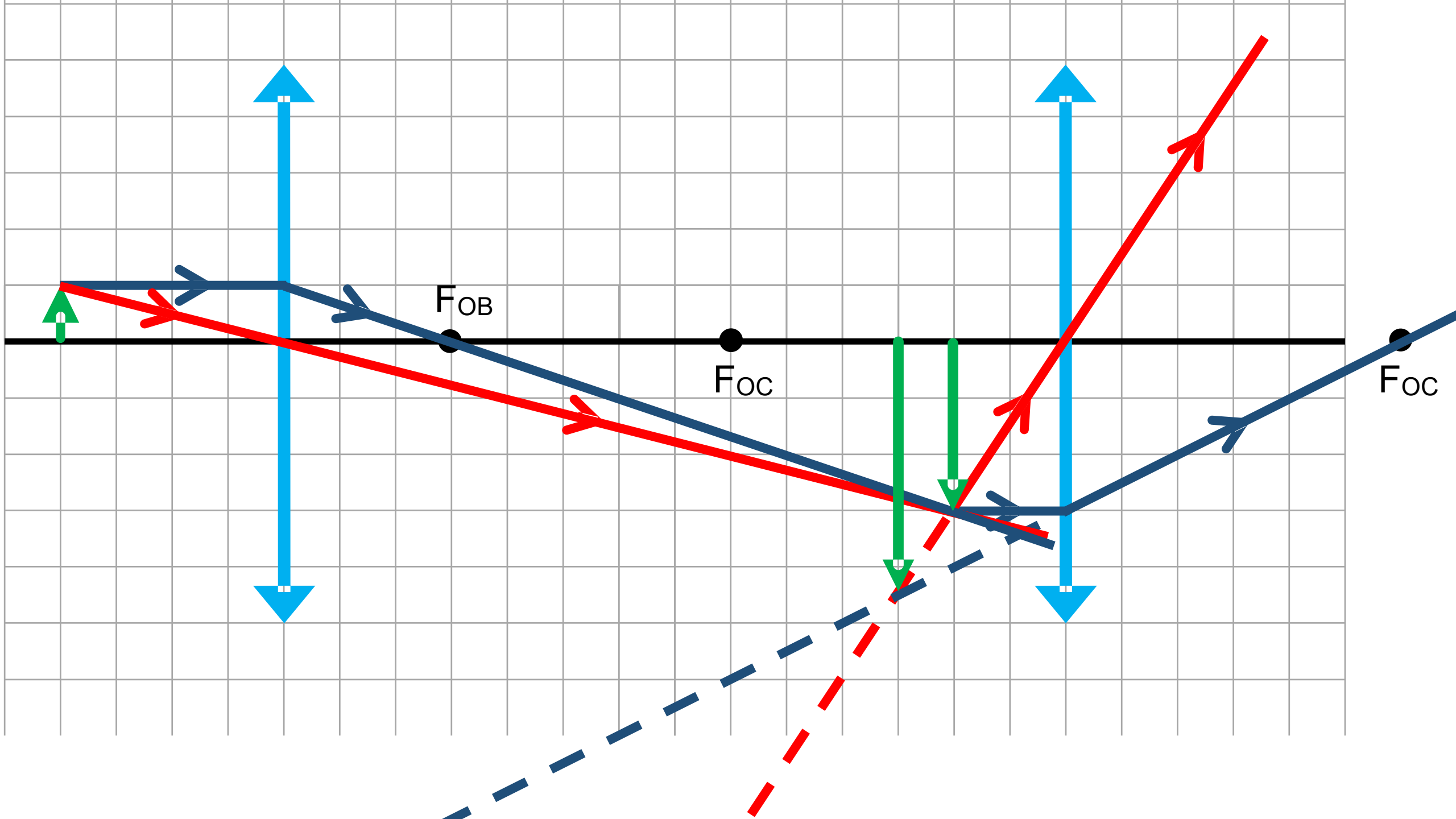

F_{OB}
F_{OC}
F_{OC}

MICROSCÓPIO

MICROSCÓPIO

- IMAGEM:

MICROSCÓPIO

- IMAGEM:
  - VIRTUAL

MICROSCÓPIO

- IMAGEM:
  - VIRTUAL
  - INVERTIDA

MICROSCÓPIO

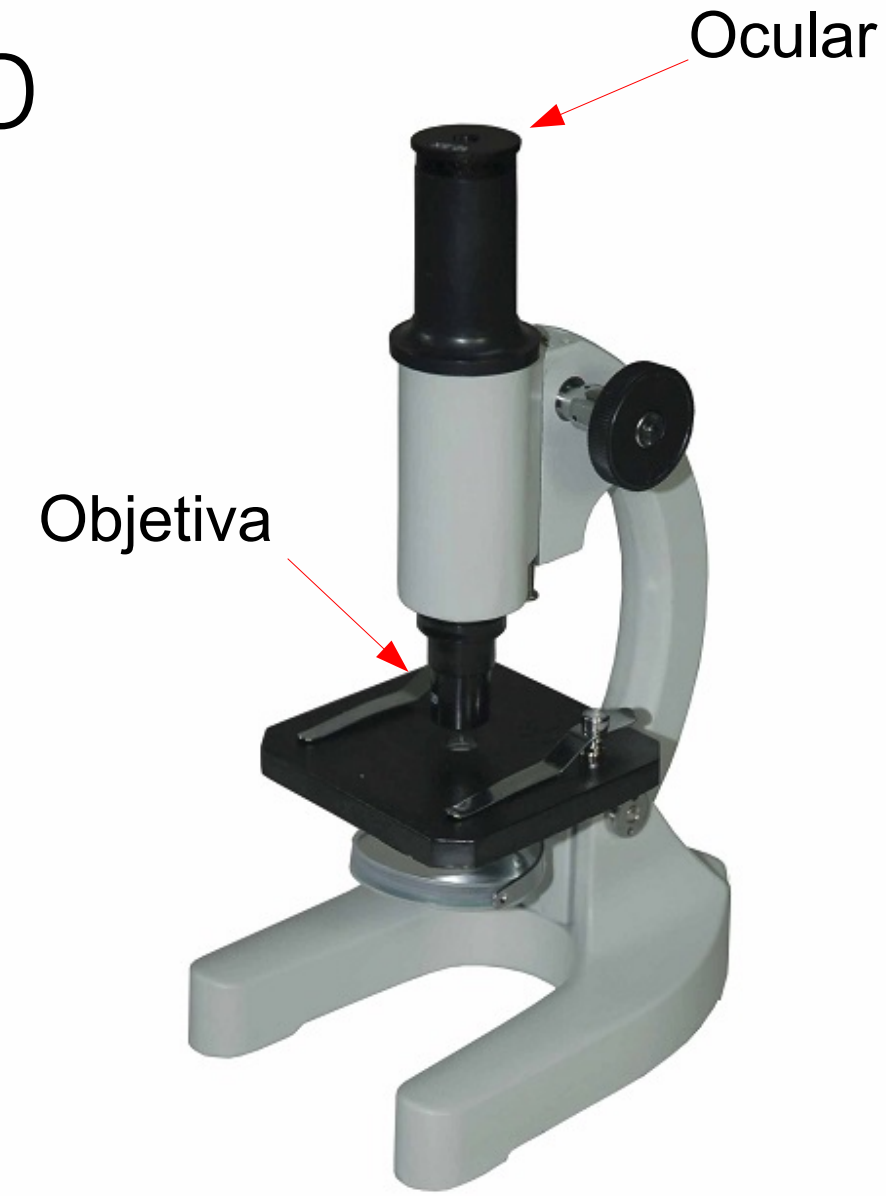
- IMAGEM:
  - VIRTUAL
  - INVERTIDA
  - MAIOR

MICROSCÓPIO

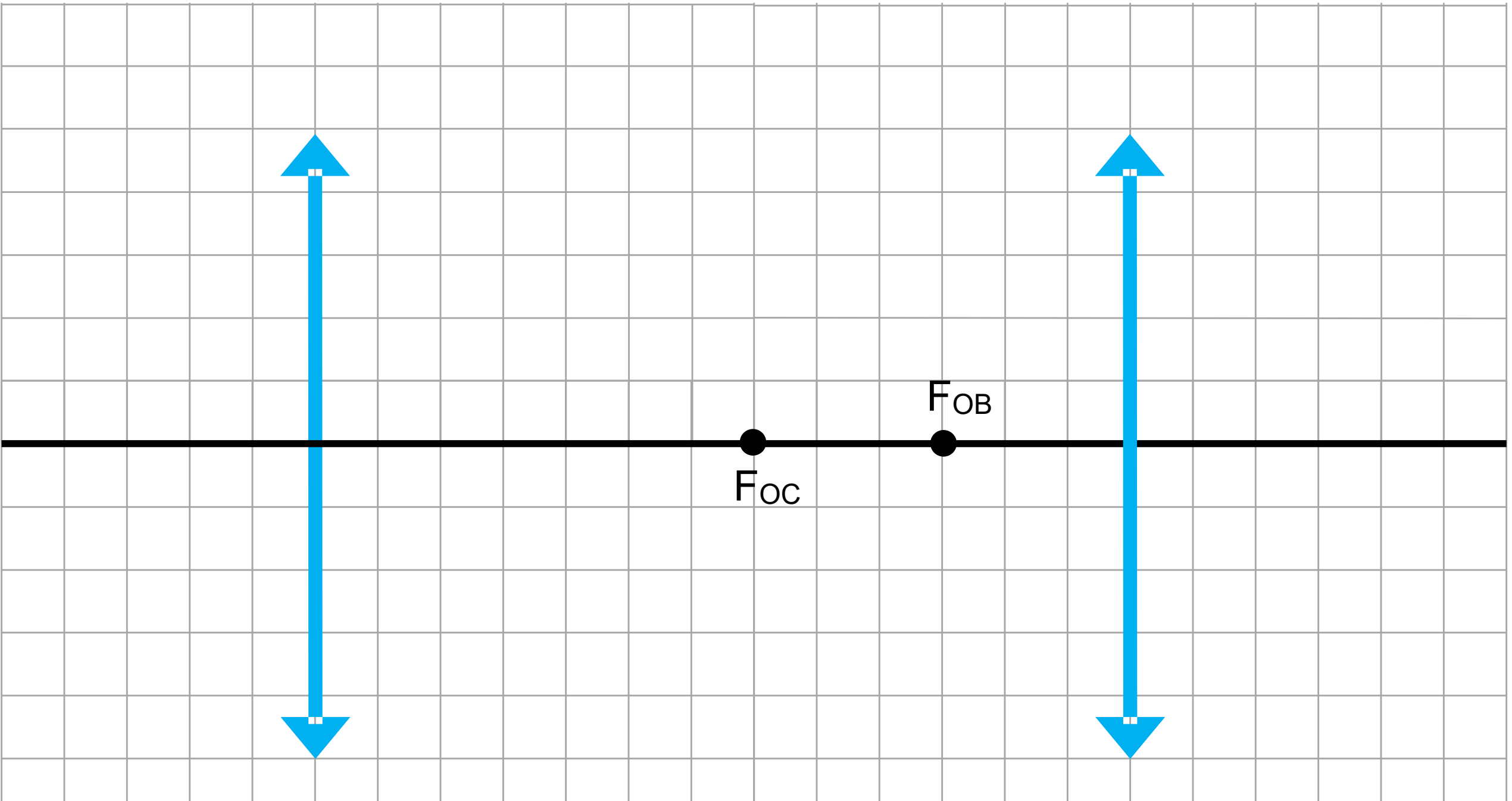
- IMAGEM:
  - VIRTUAL
  - INVERTIDA
  - MAIOR
  - AUMENTO:

MICROSCÓPIO

- IMAGEM:
  - VIRTUAL
  - INVERTIDA
  - MAIOR
  - AUMENTO: $A = A_{OB} \cdot A_{OC}$



Q. 14 - LUNETA ASTRONÔMICA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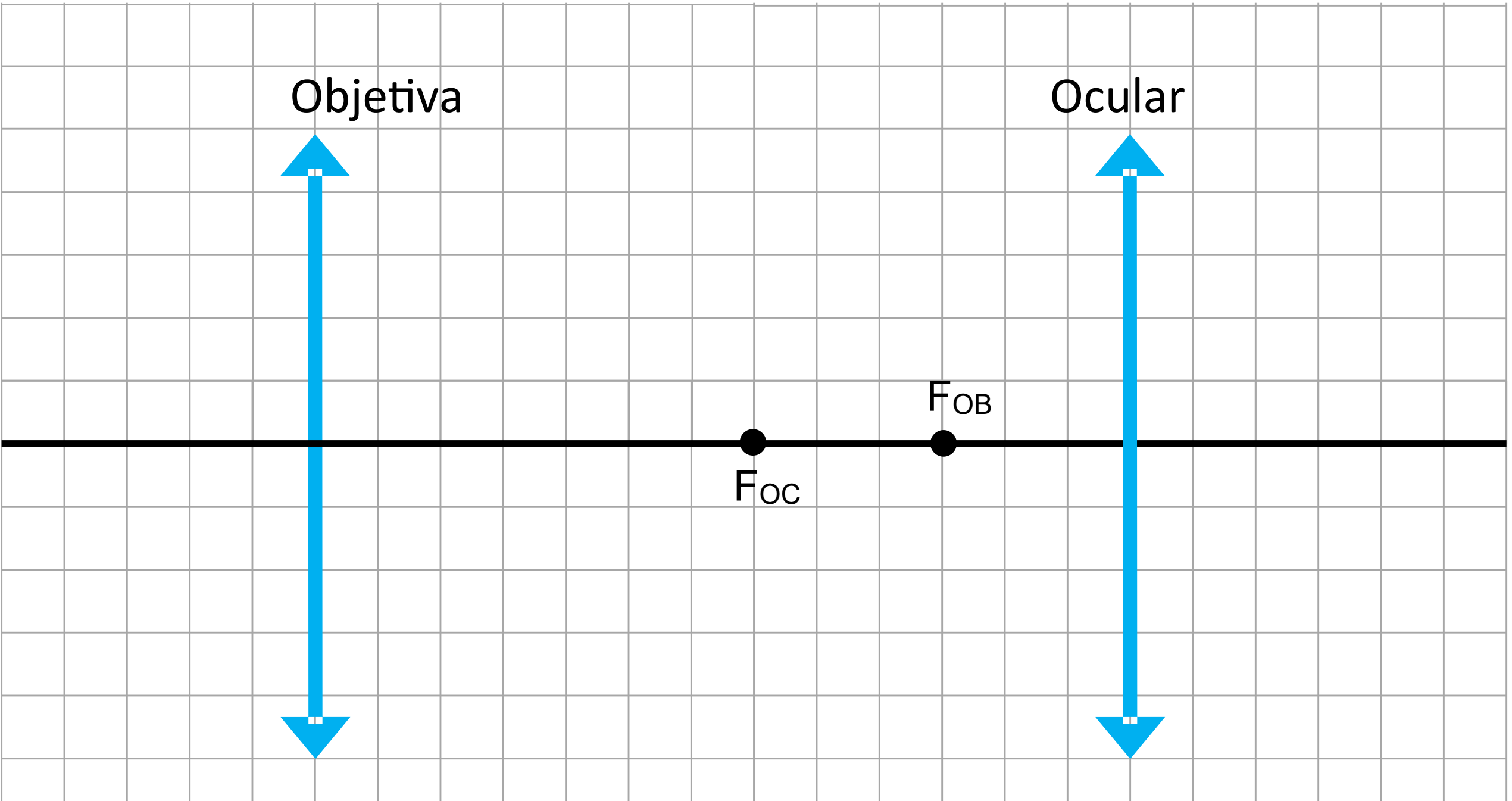
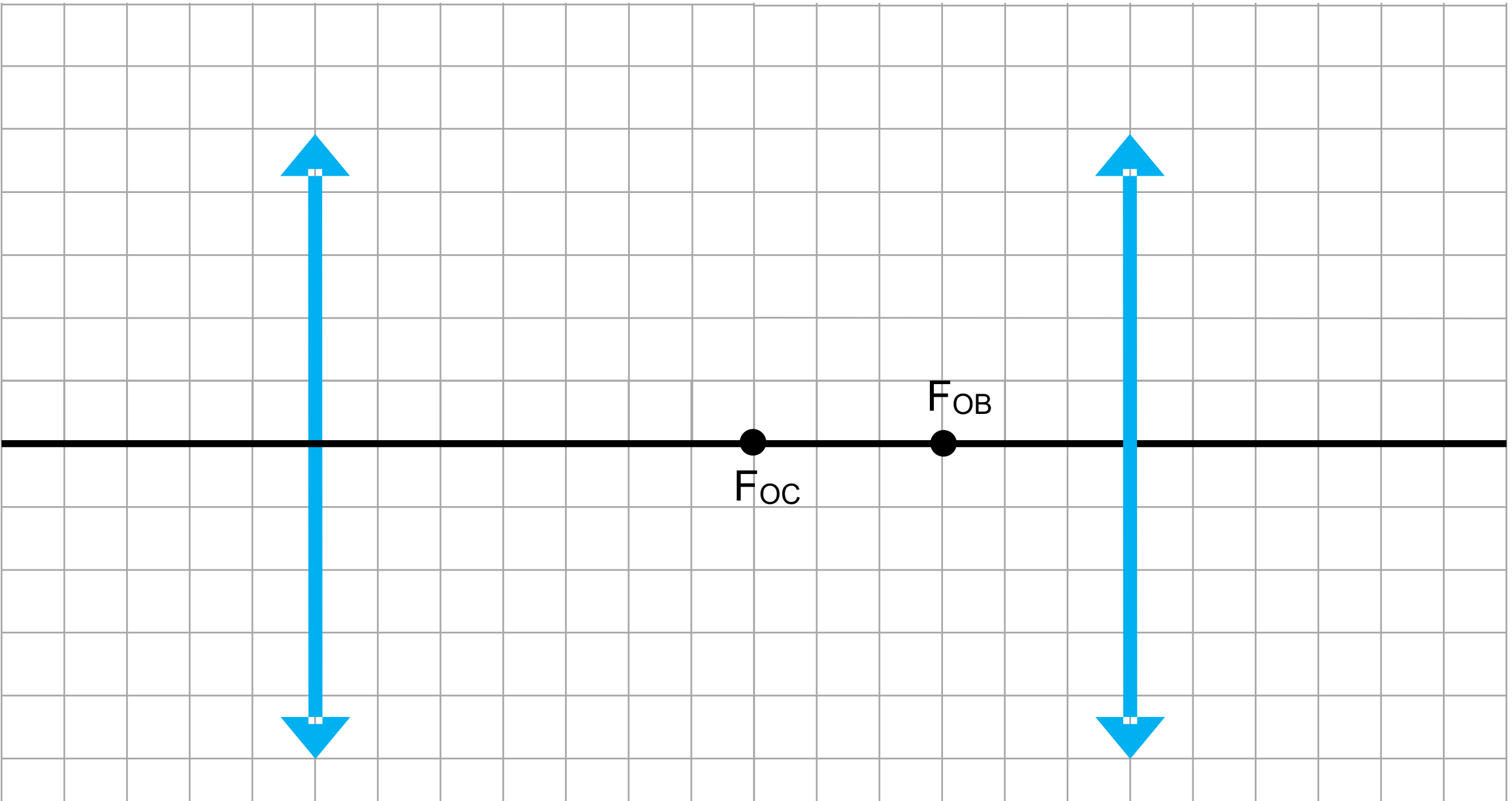
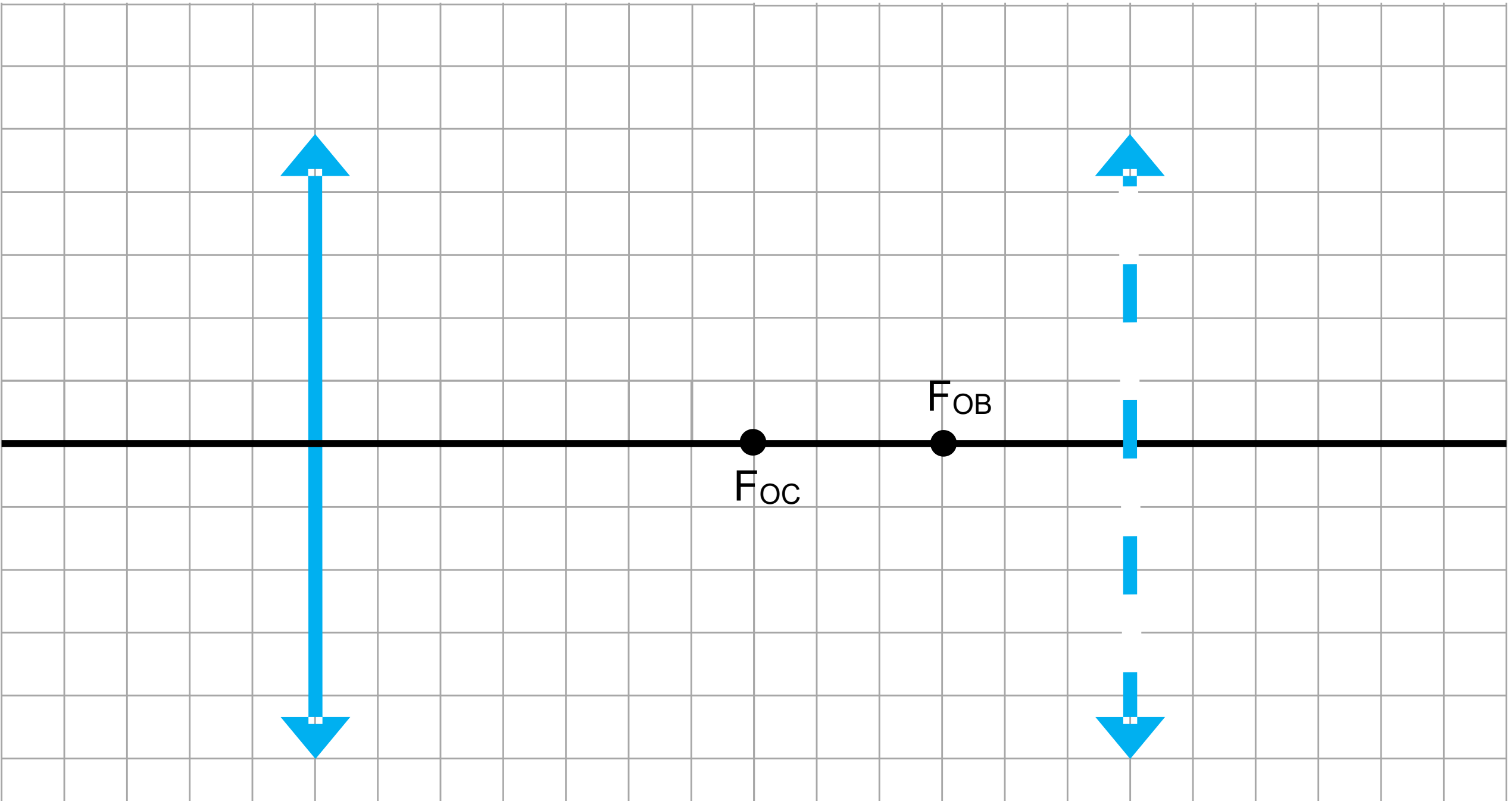
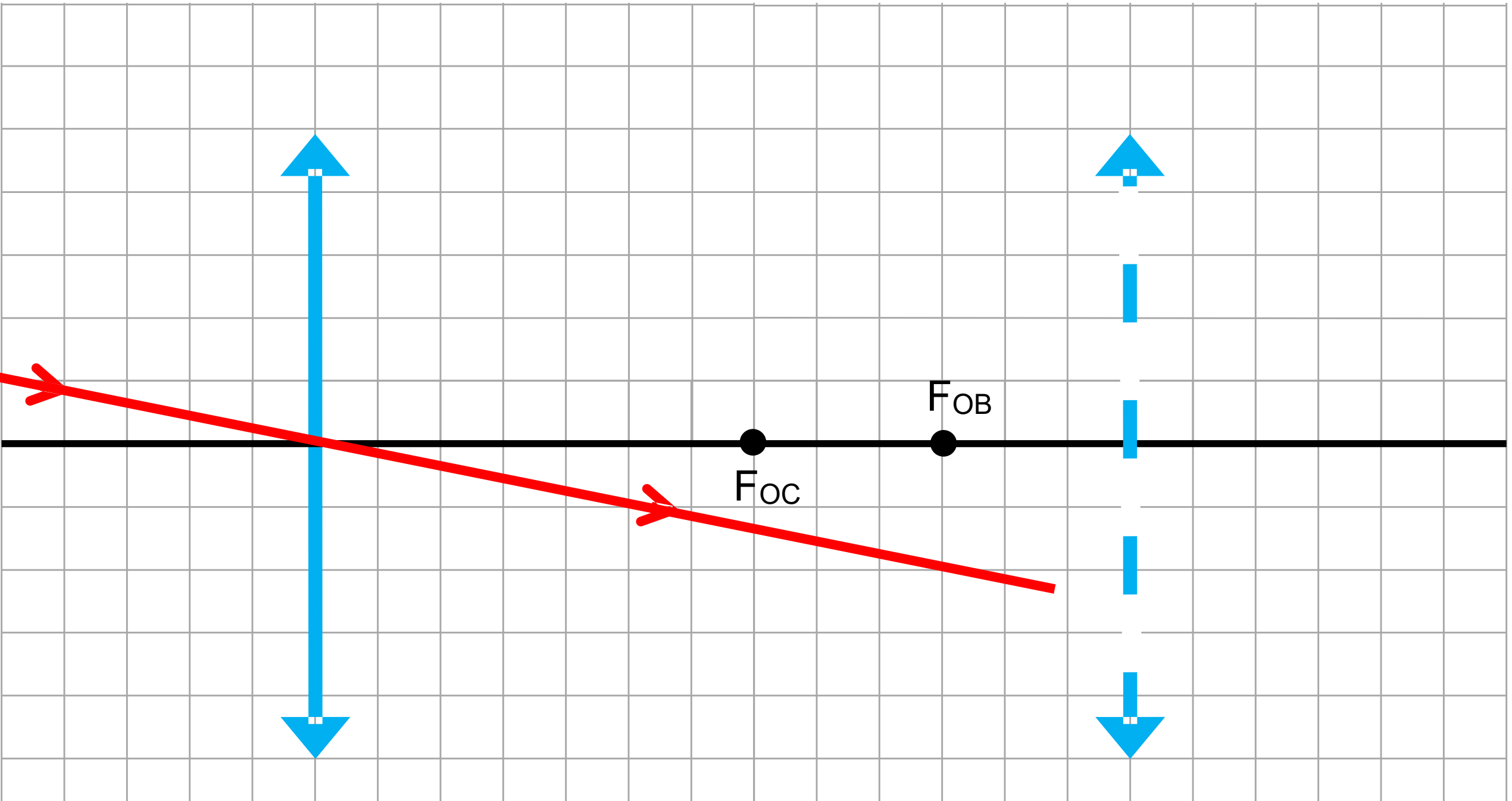
F_{OC}


Objetiva
Ocular
F_{OB}
F_{OC}


F_{OB}
F_{OC}


F_{OB}
F_{OC}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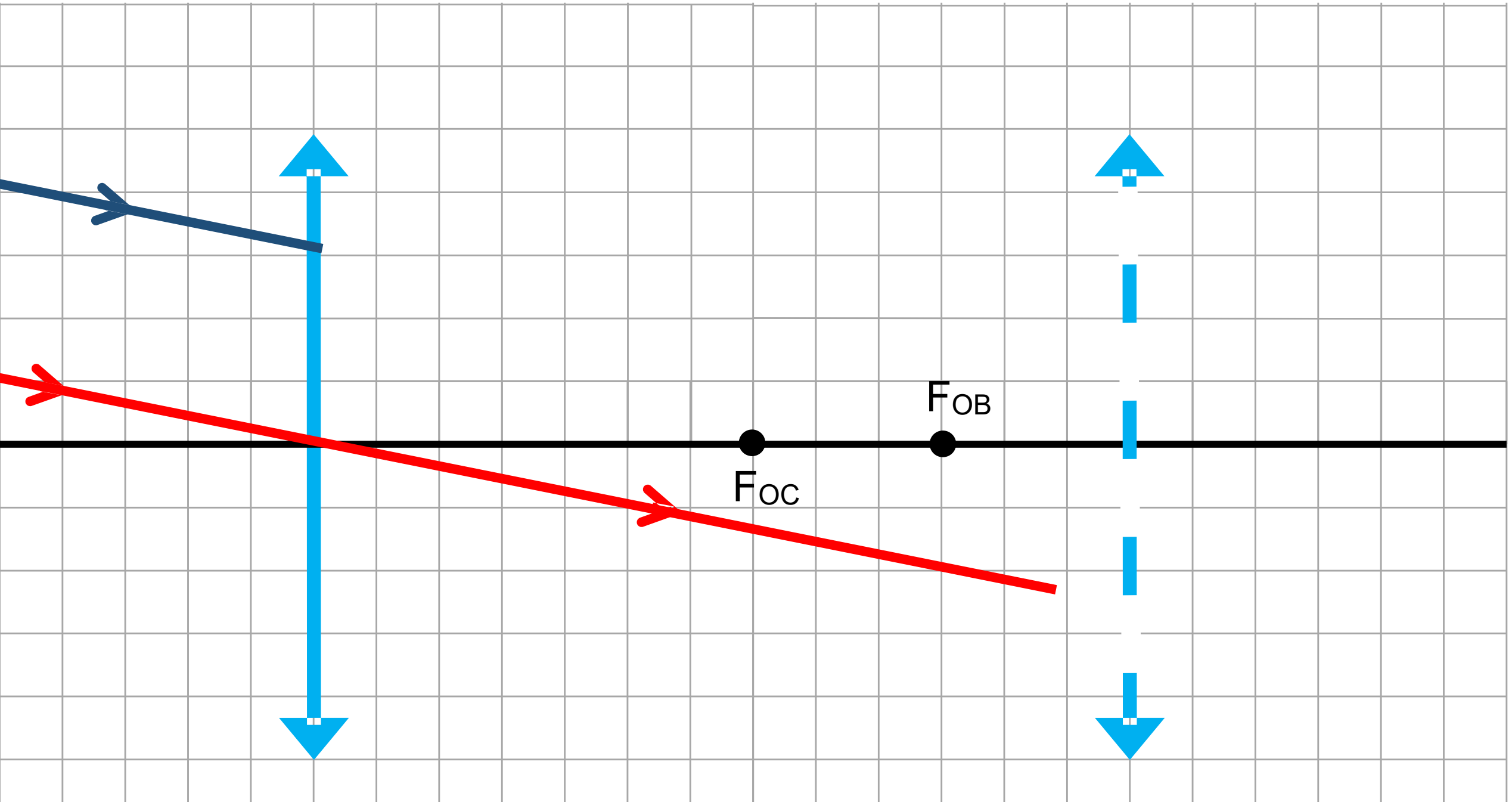
F_{OC}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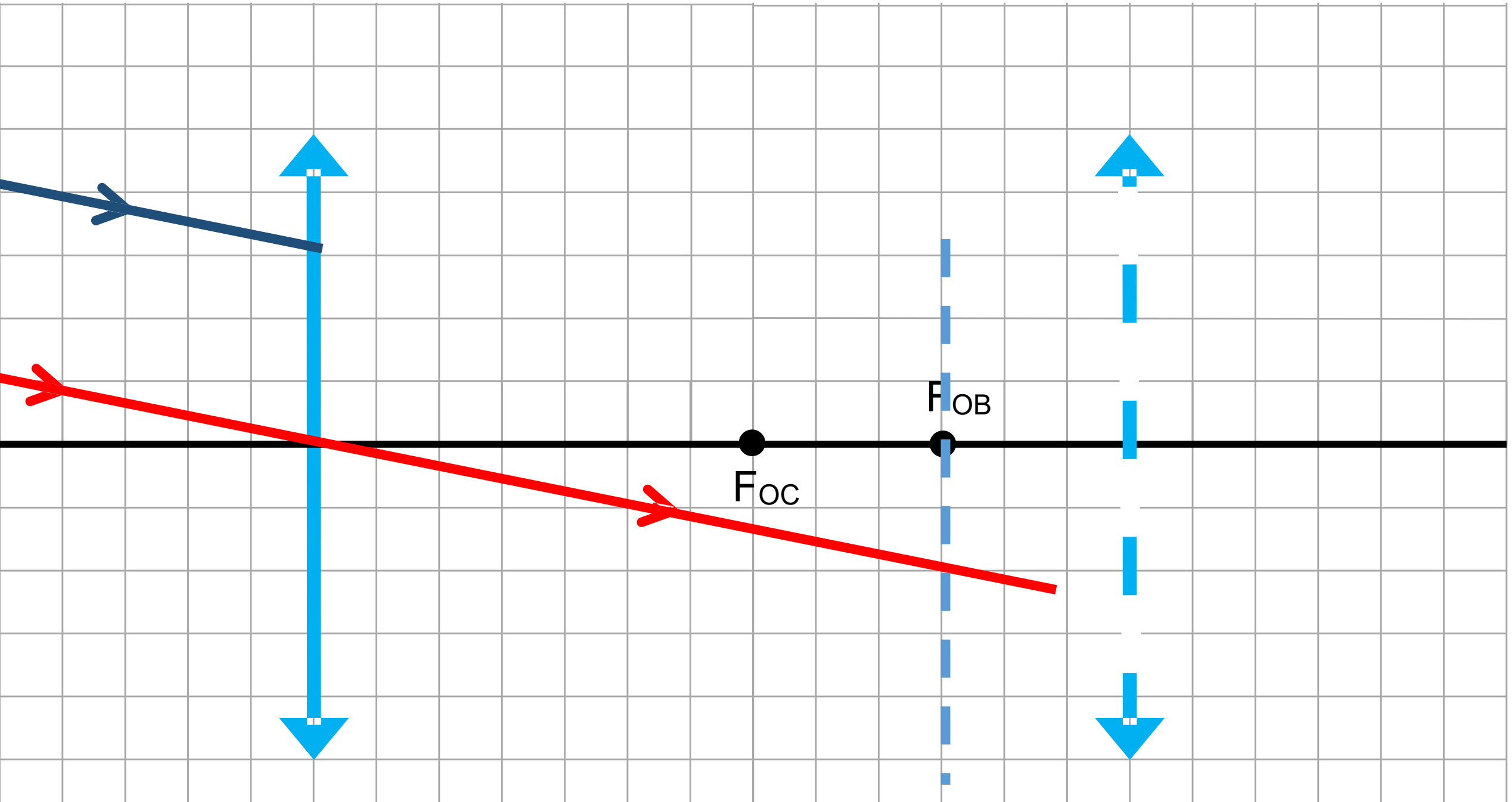
F_{OC}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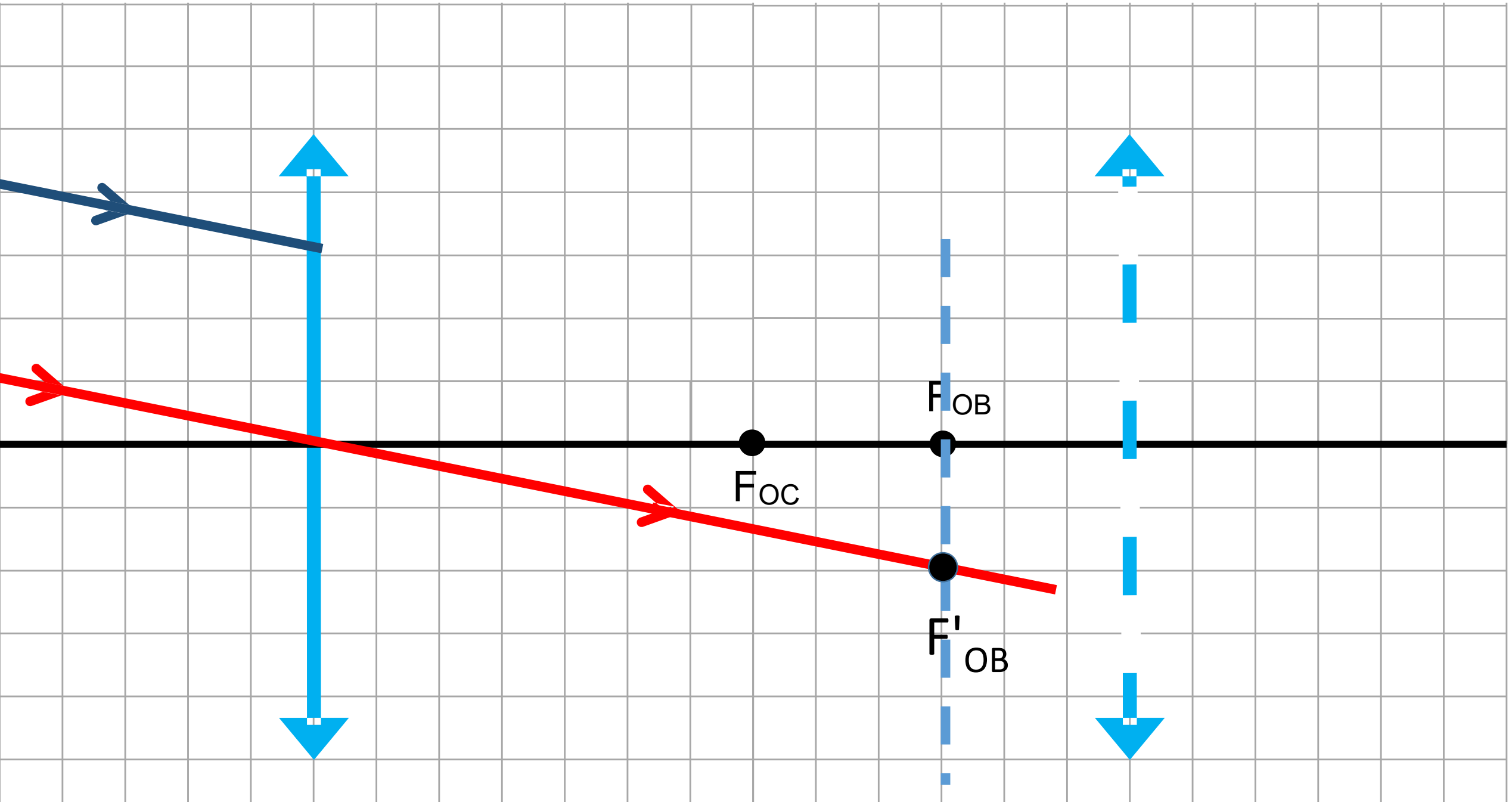
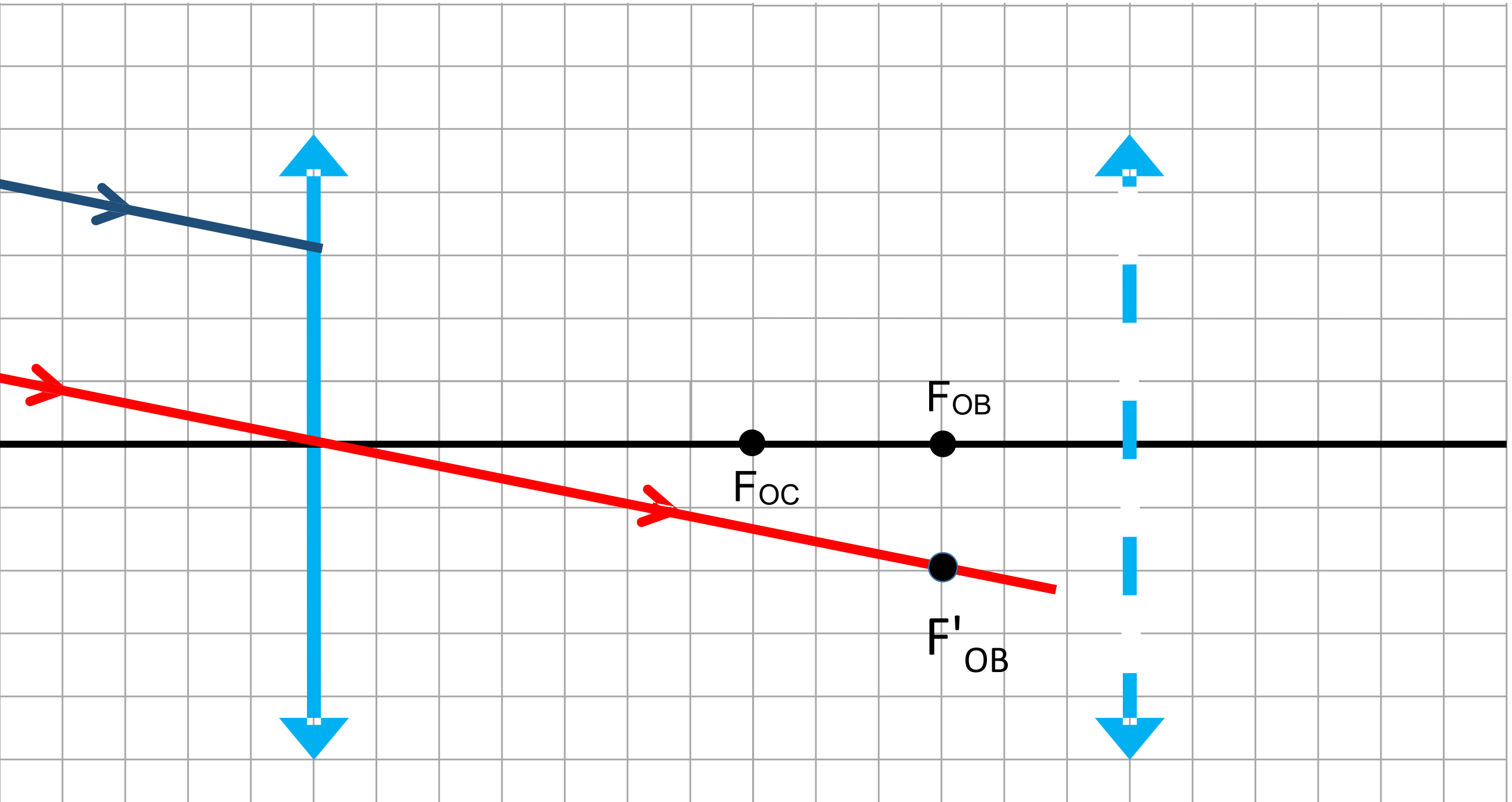
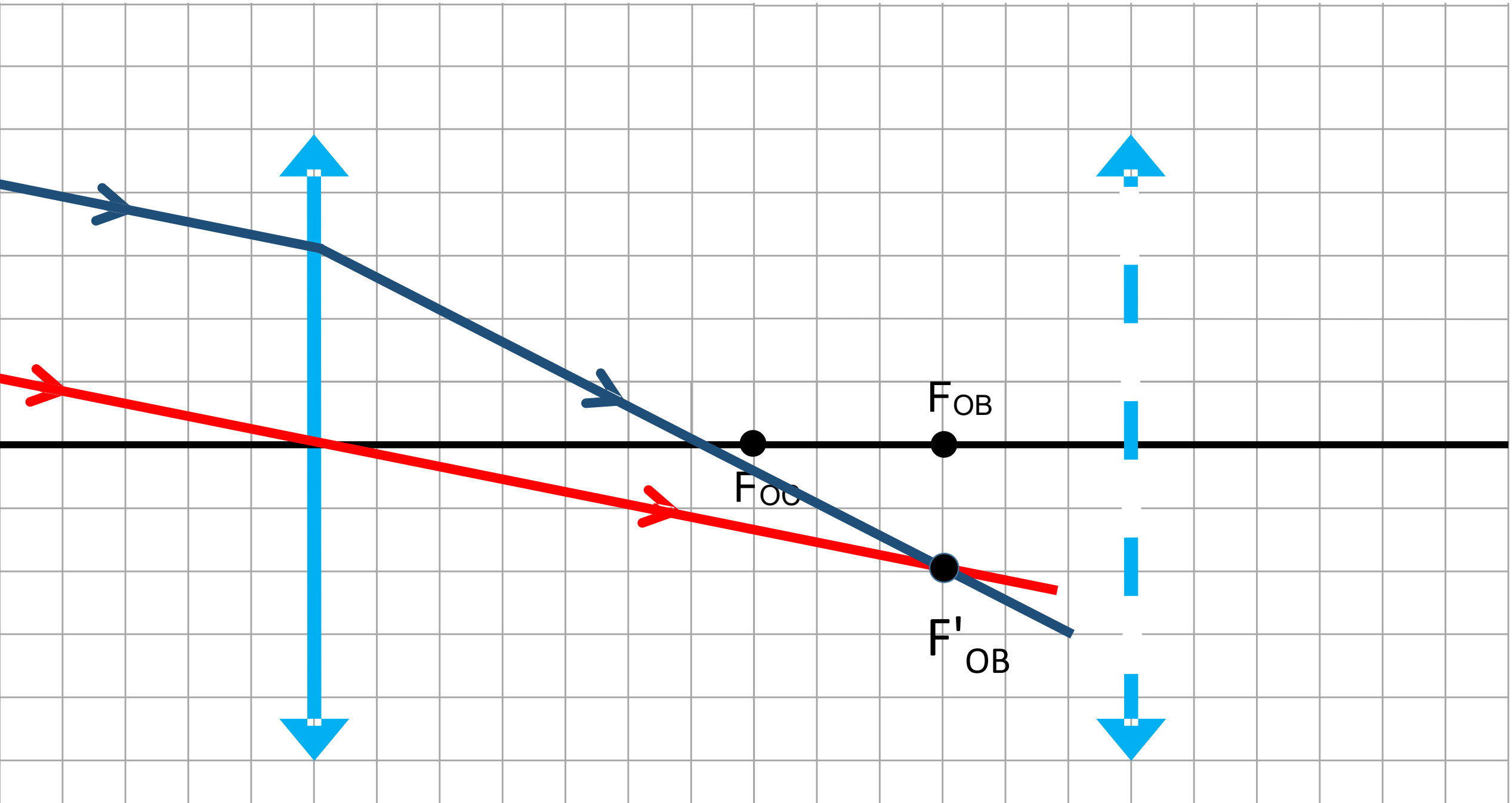
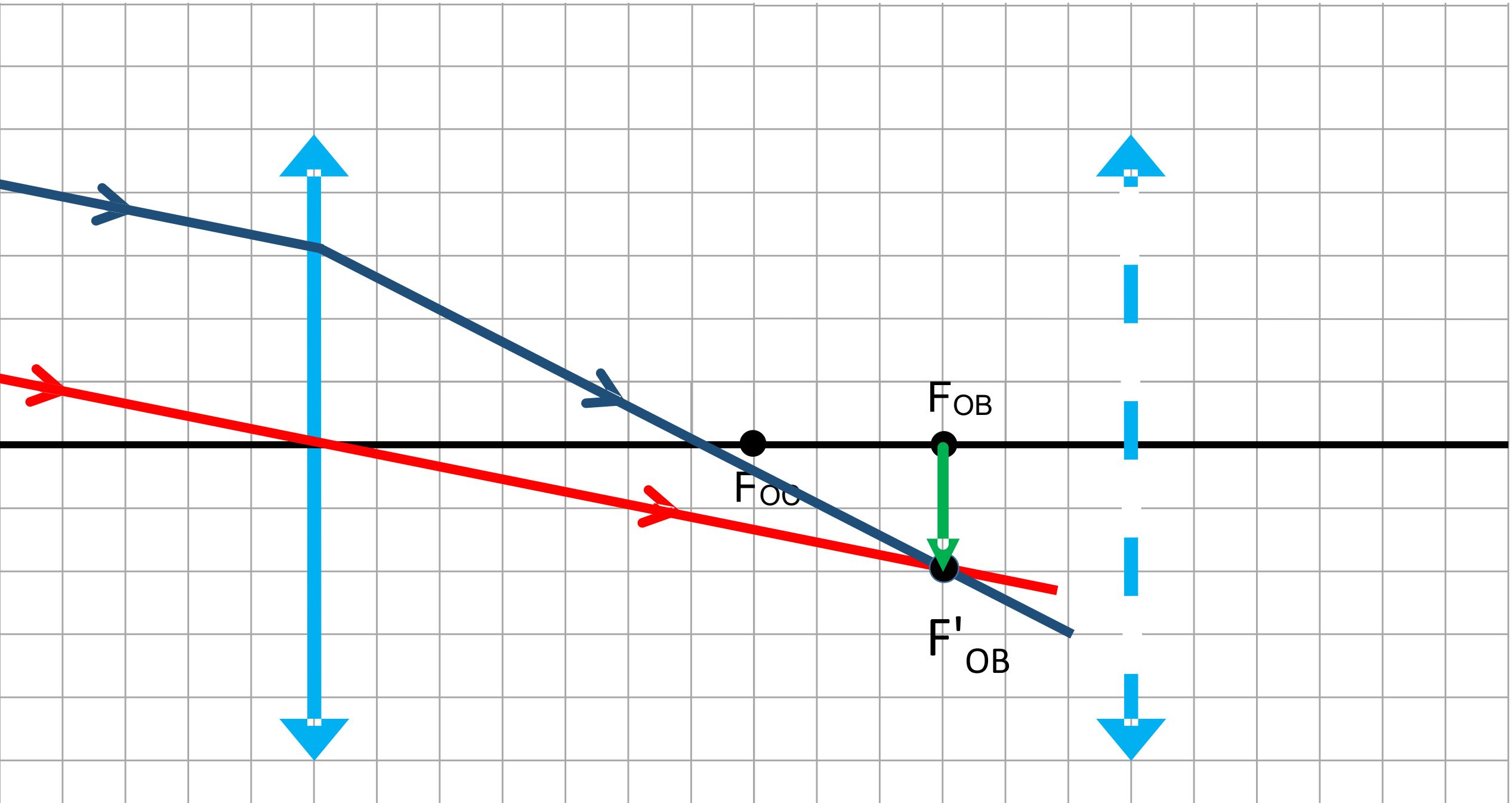
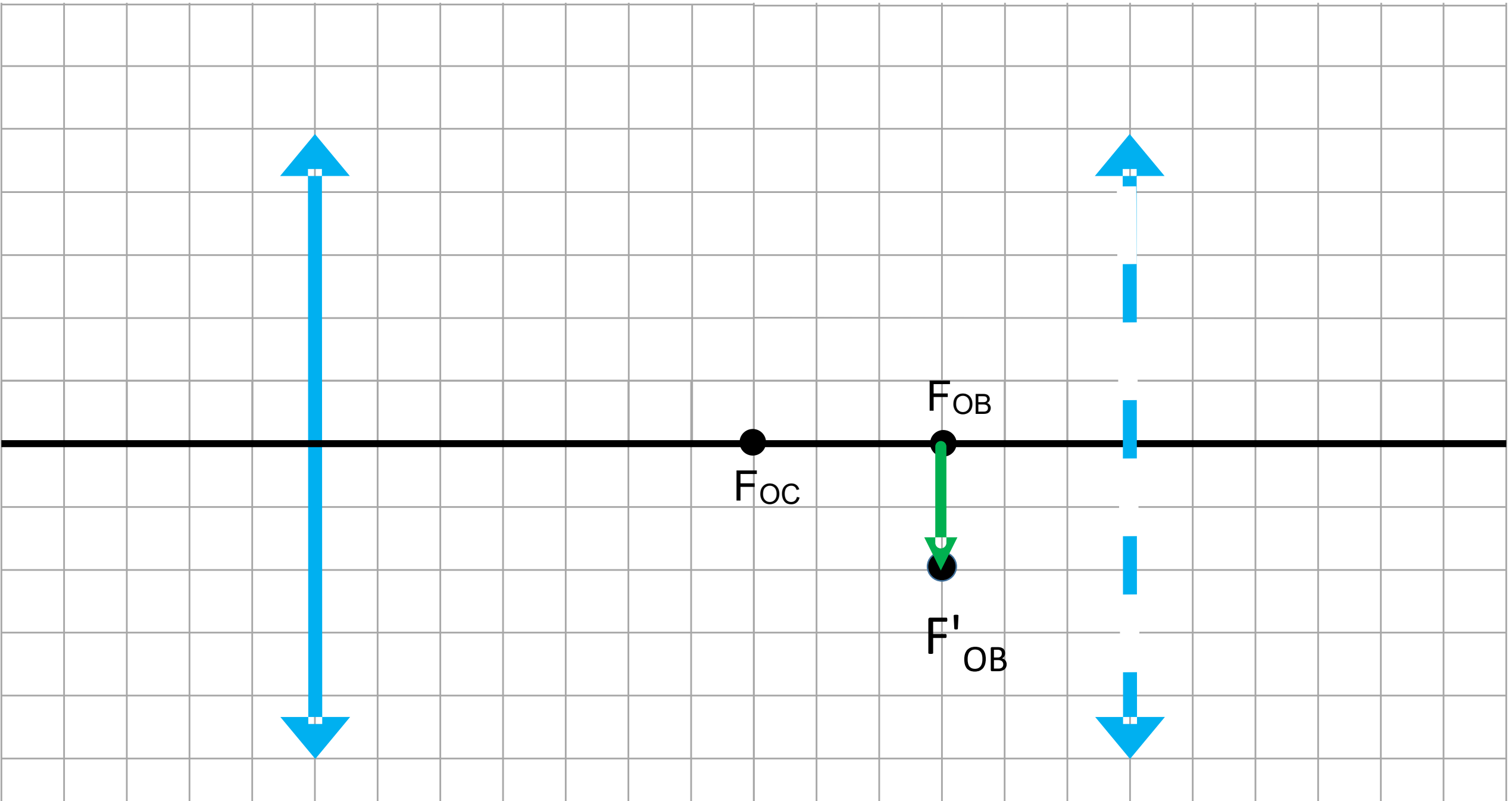
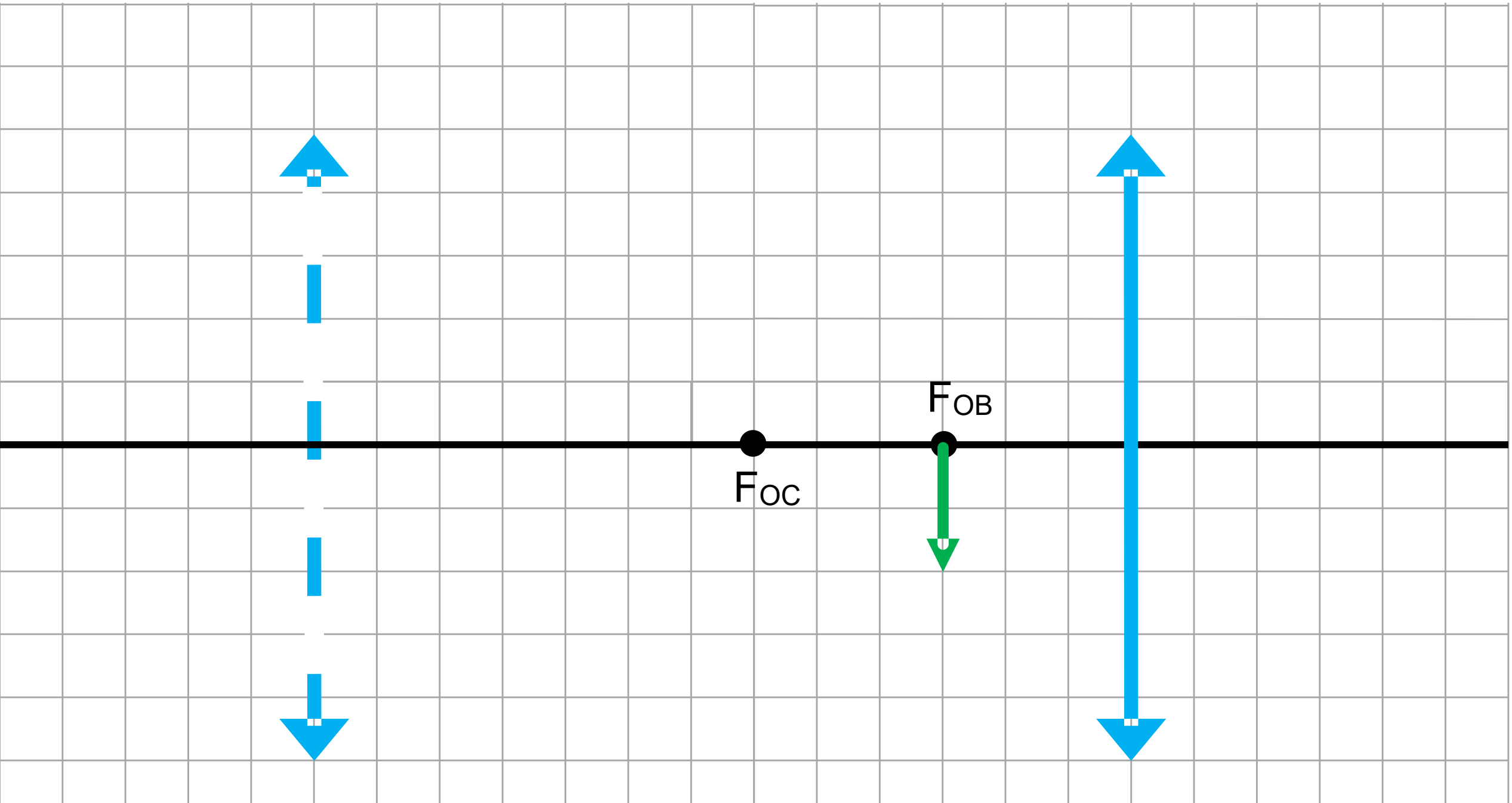

F OB
F OC
F' OB


F_{OB}
F_{OC}
F'_{OB}


F_OB
F_OC
F'_OB


F OB
F OC
F' OB


F_{OB}
F_{OC}
F'_{OB}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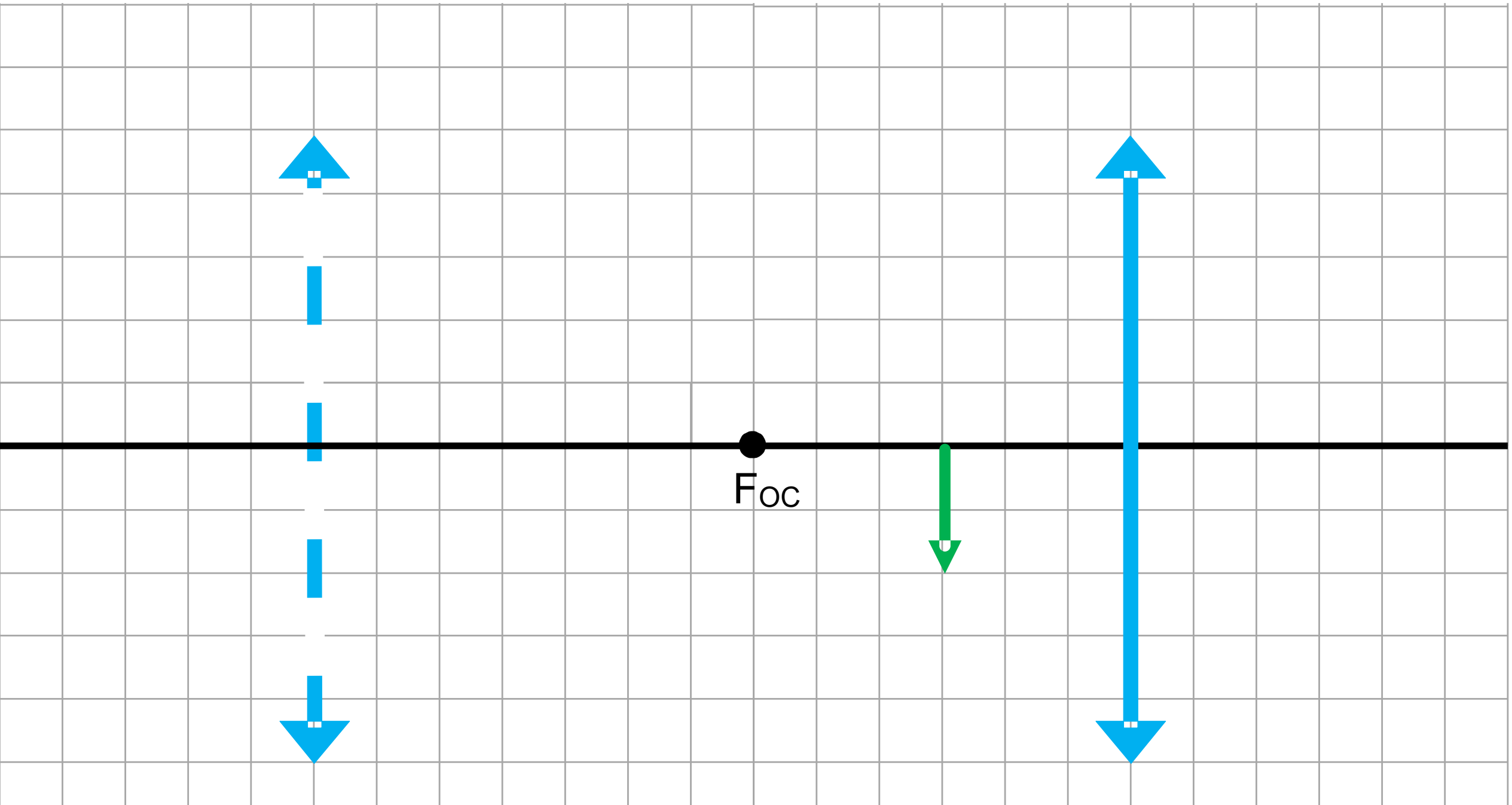
F_{OC}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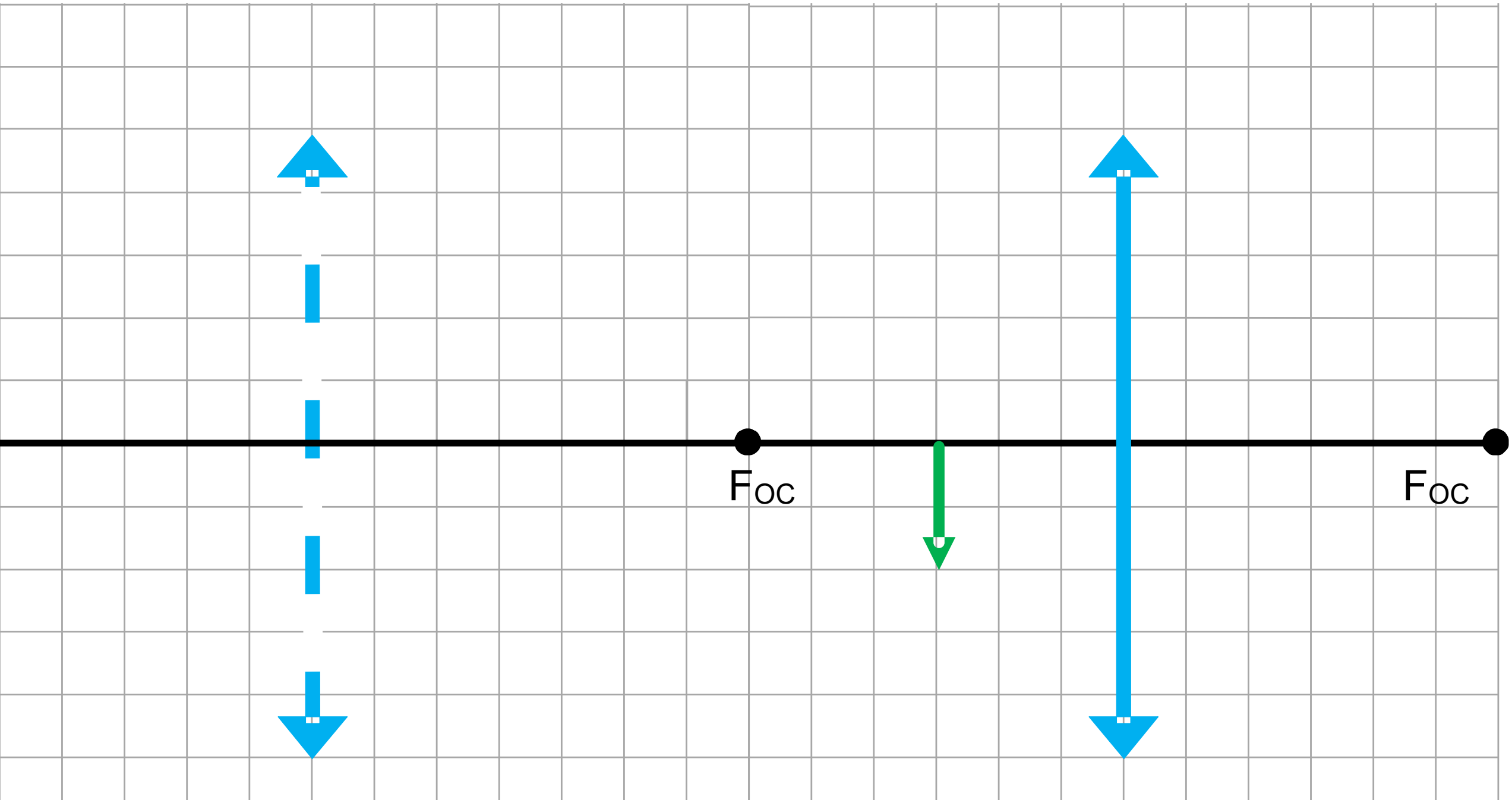
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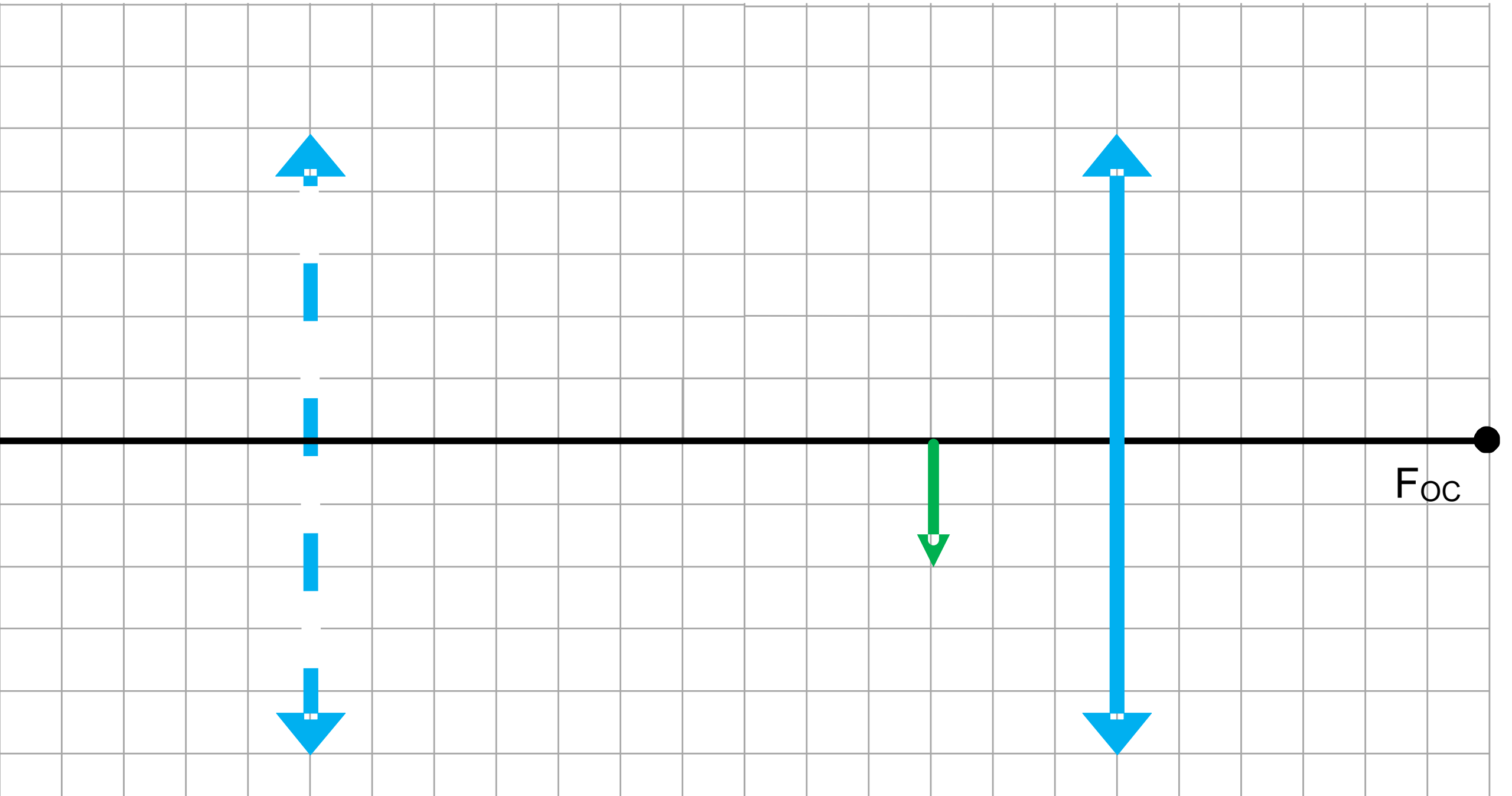
Foc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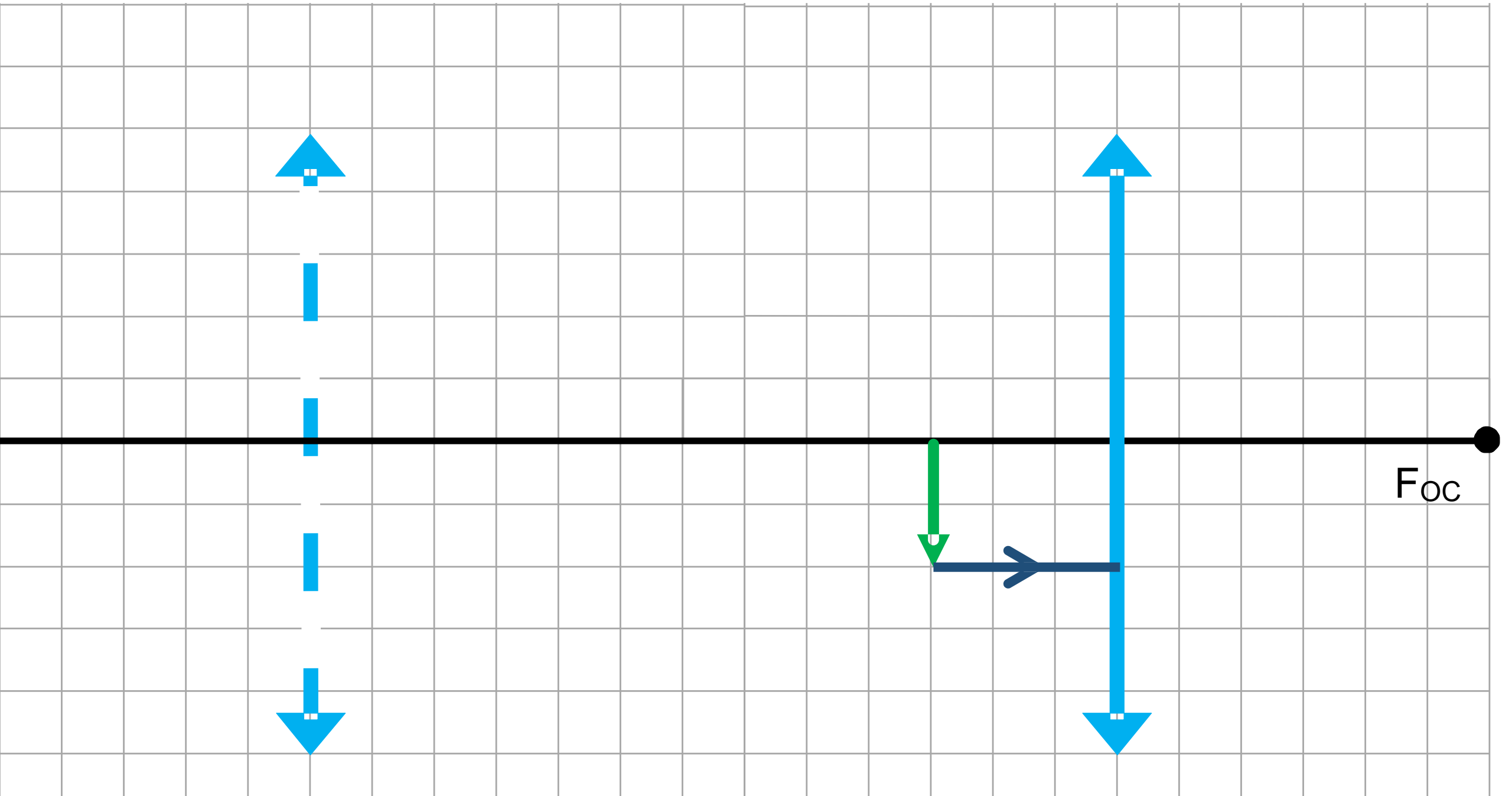
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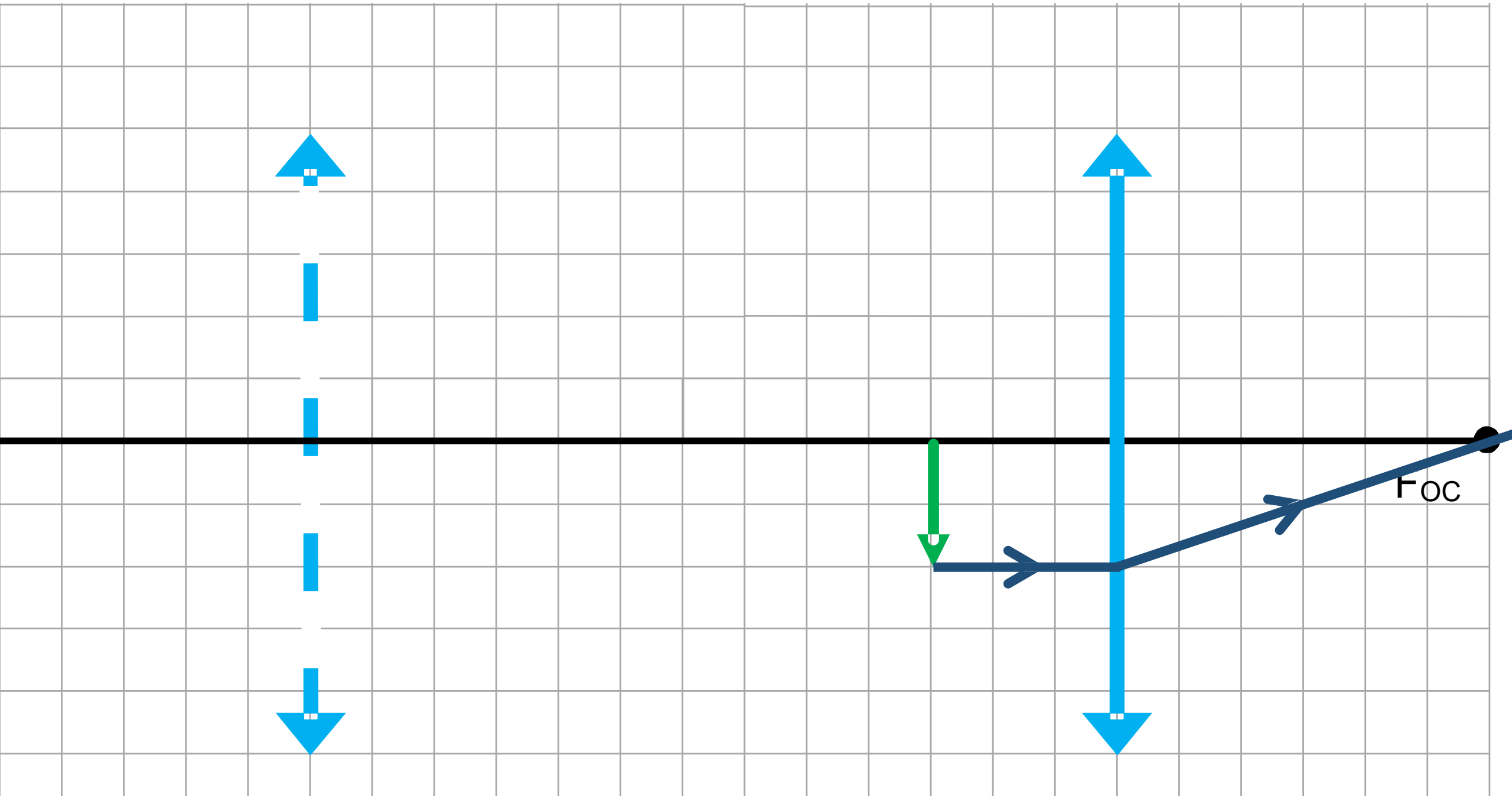
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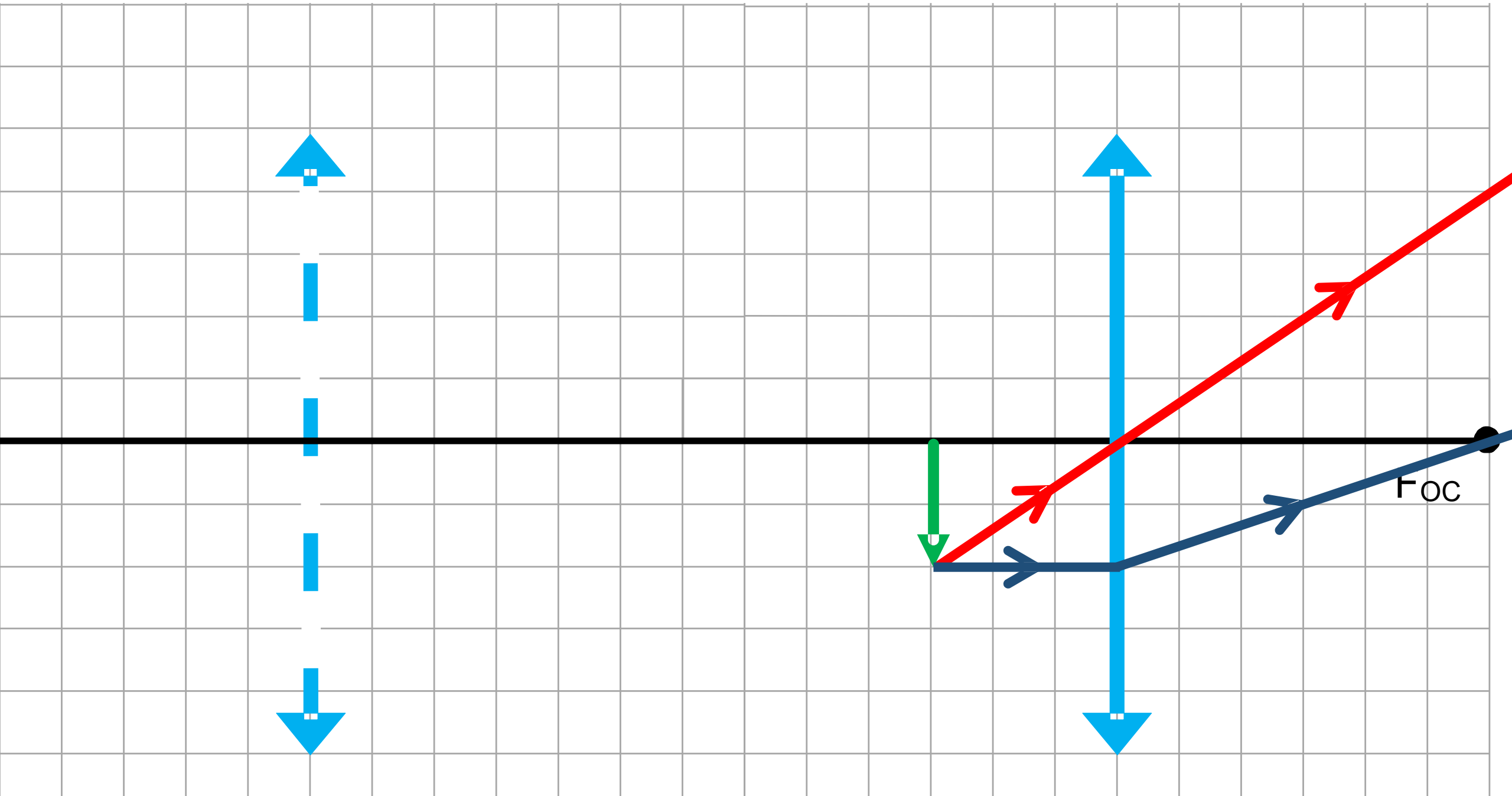
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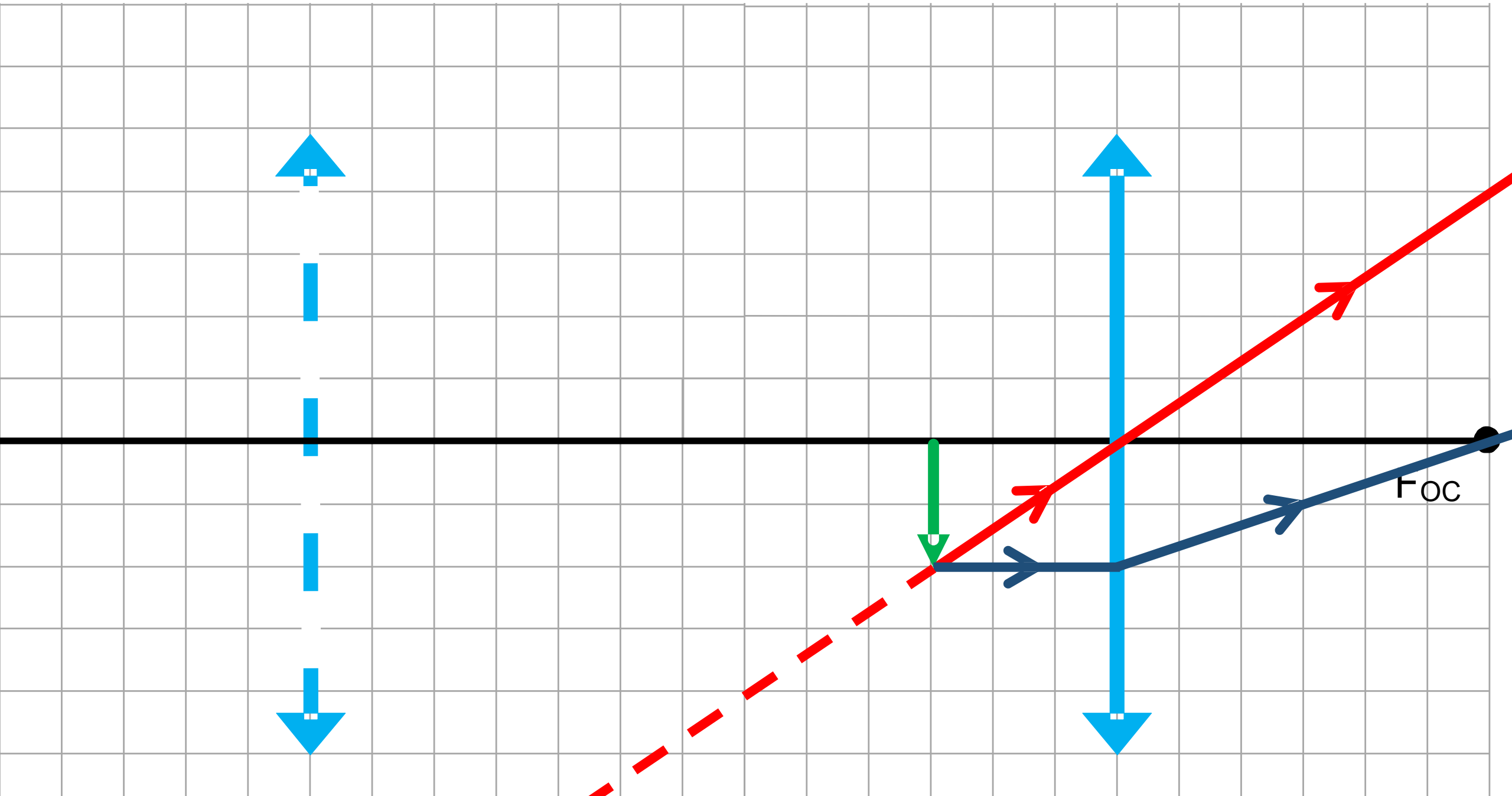
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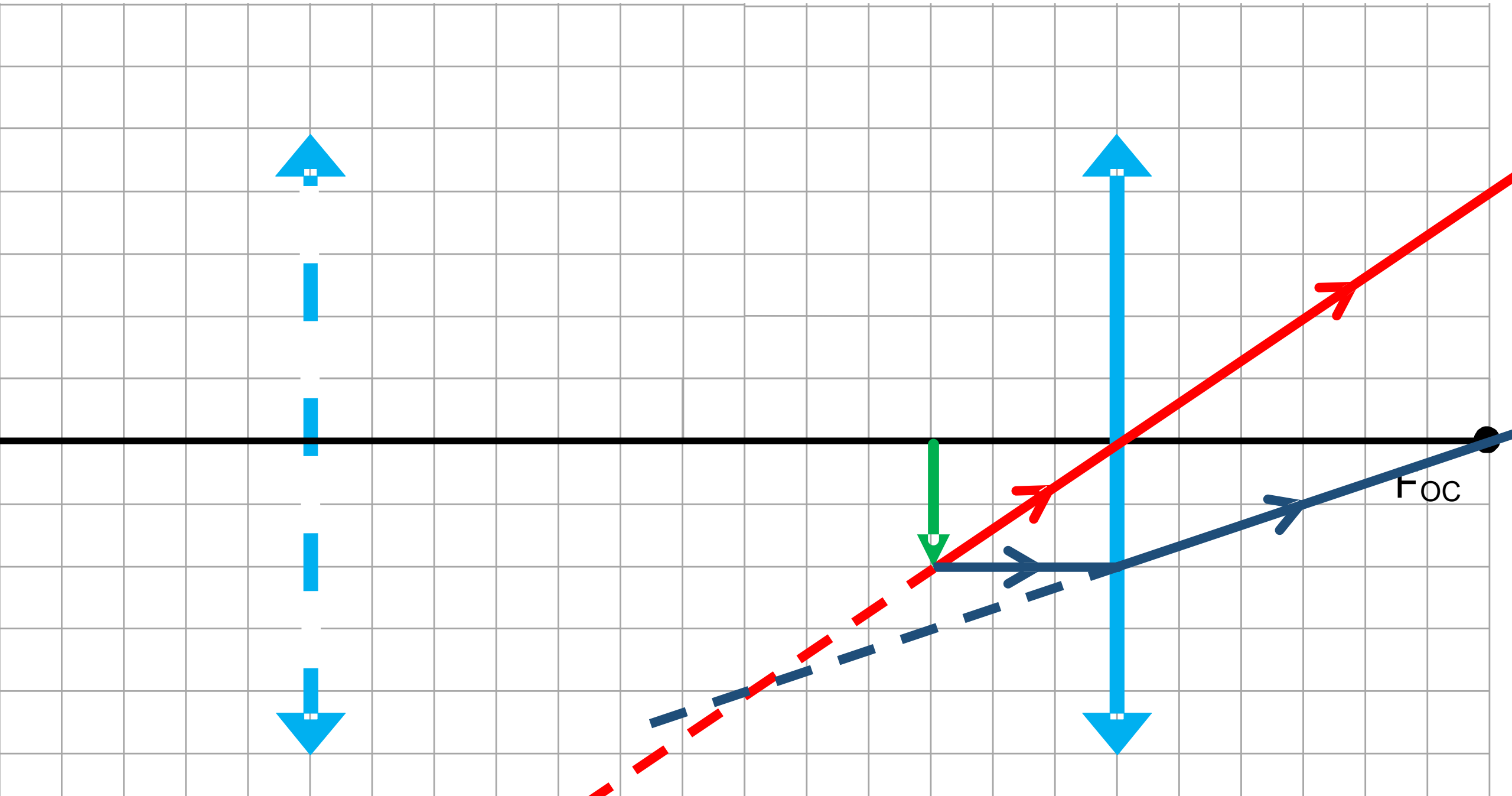
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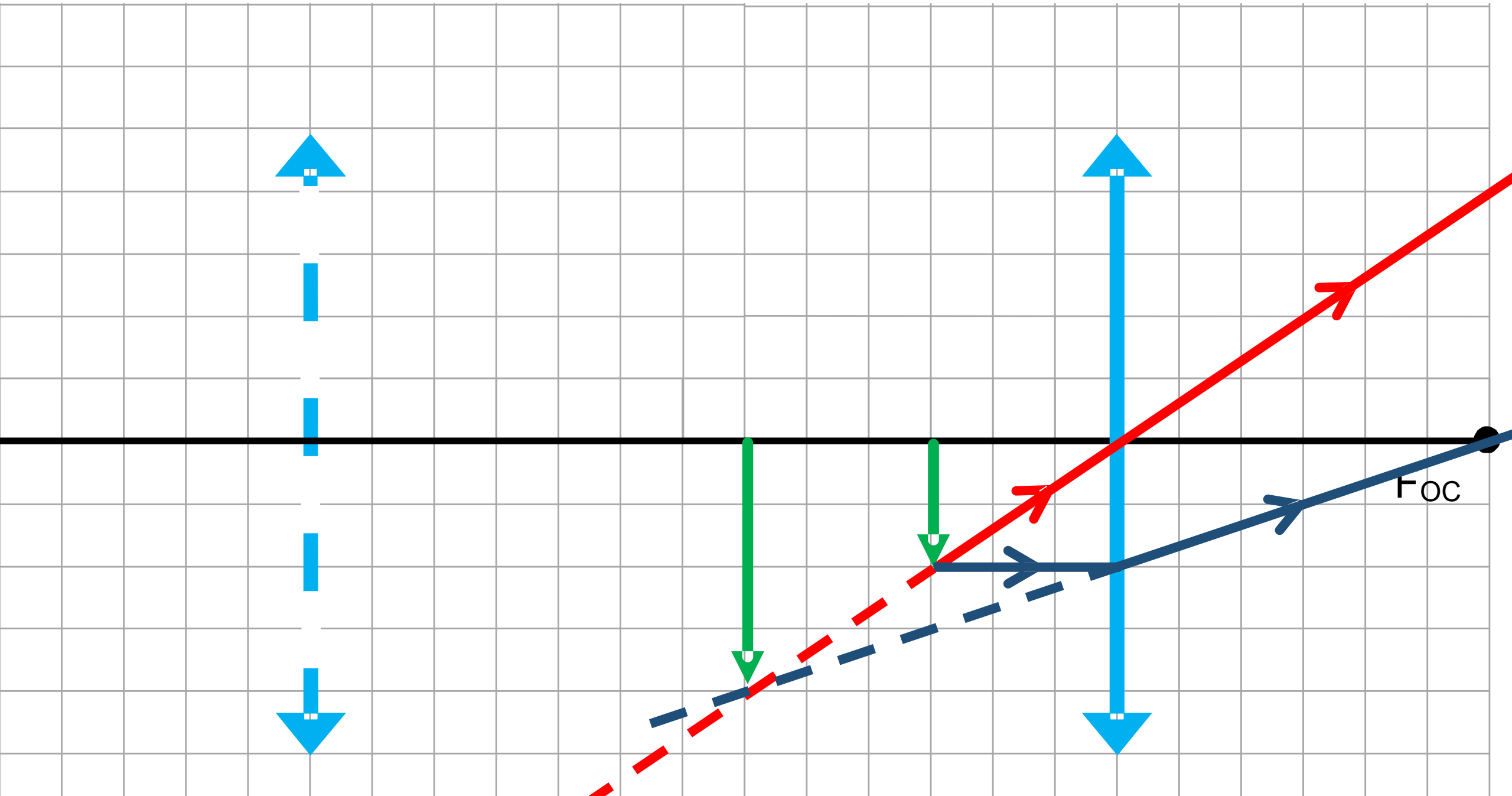
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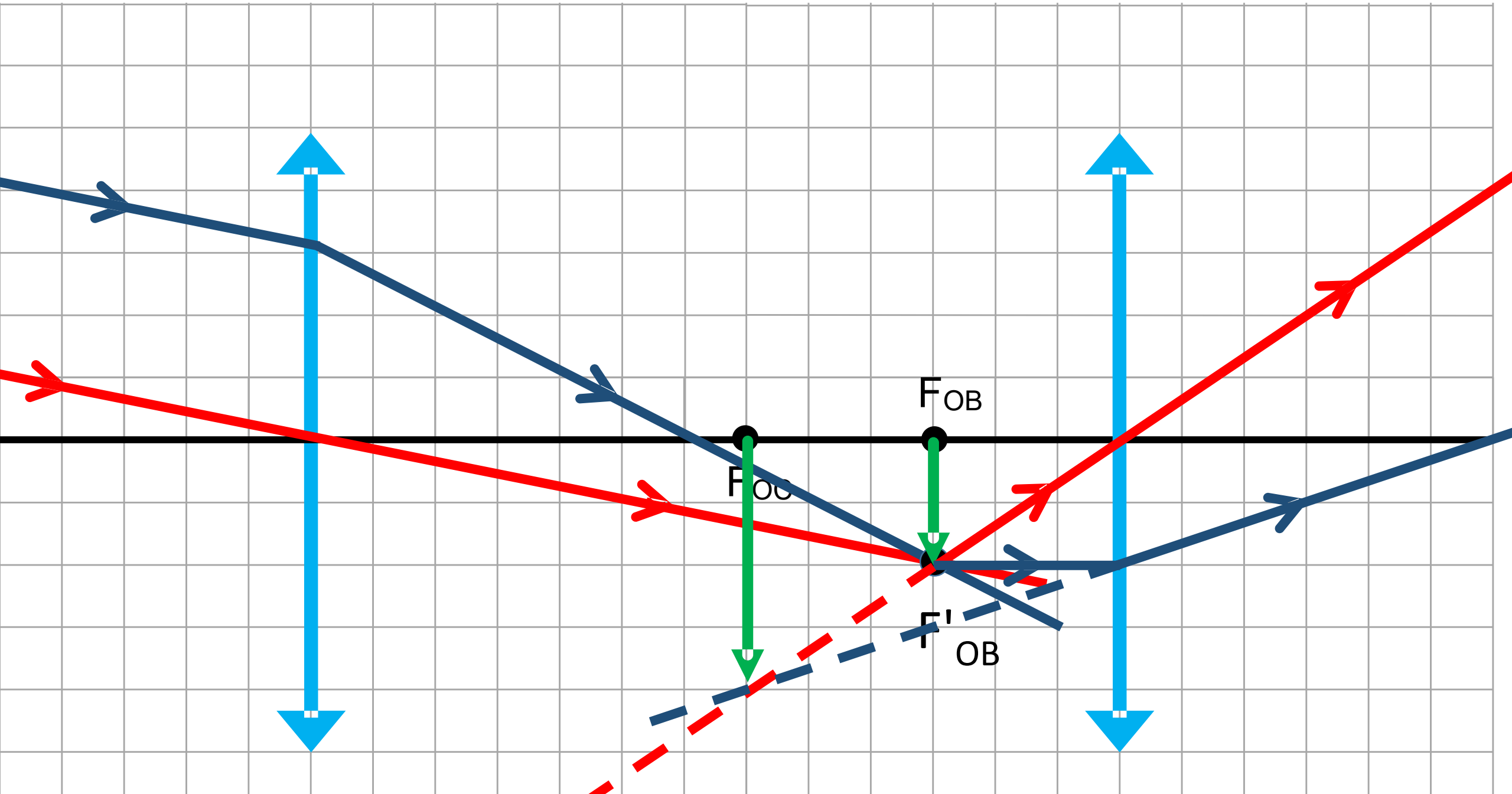

F'OB
FOB
FOC

LUNETA ASTRONÔMICA

LUNETA ASTRONÔMICA

- IMAGEM:

LUNETA ASTRONÔMICA

- IMAGEM:
  - VIRTUAL

LUNETA ASTRONÔMICA

- IMAGEM:
  - VIRTUAL
  - INVERTIDA

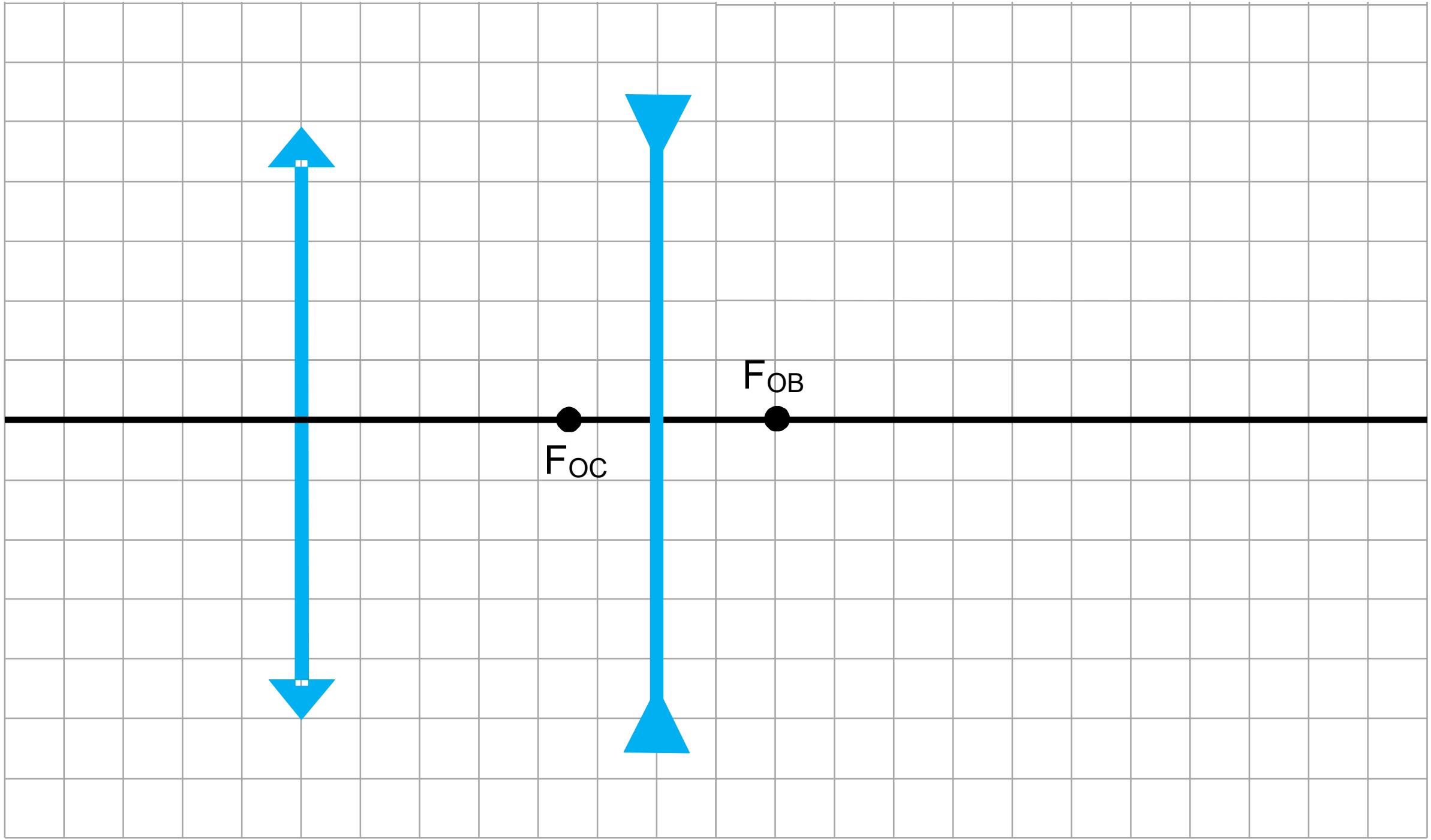
LUNETA ASTRONÔMICA

- IMAGEM:
  - VIRTUAL
  - INVERTIDA
  - QUANTO AO TAMANHO, DIZEMOS QUE HÁ UM AUMENTO ANGULAR (*M*), UMA VEZ QUE A IMAGEM FINAL É PONTUAL

LUNETA ASTRONÔMICA → TELESCÓPIO

- Os telescópios refratores são como lunetas, mas com um pequeno espelho plano próximo à ocular para ficar mais confortável a observação.

Q. 15 - LUNETA TERRESTRE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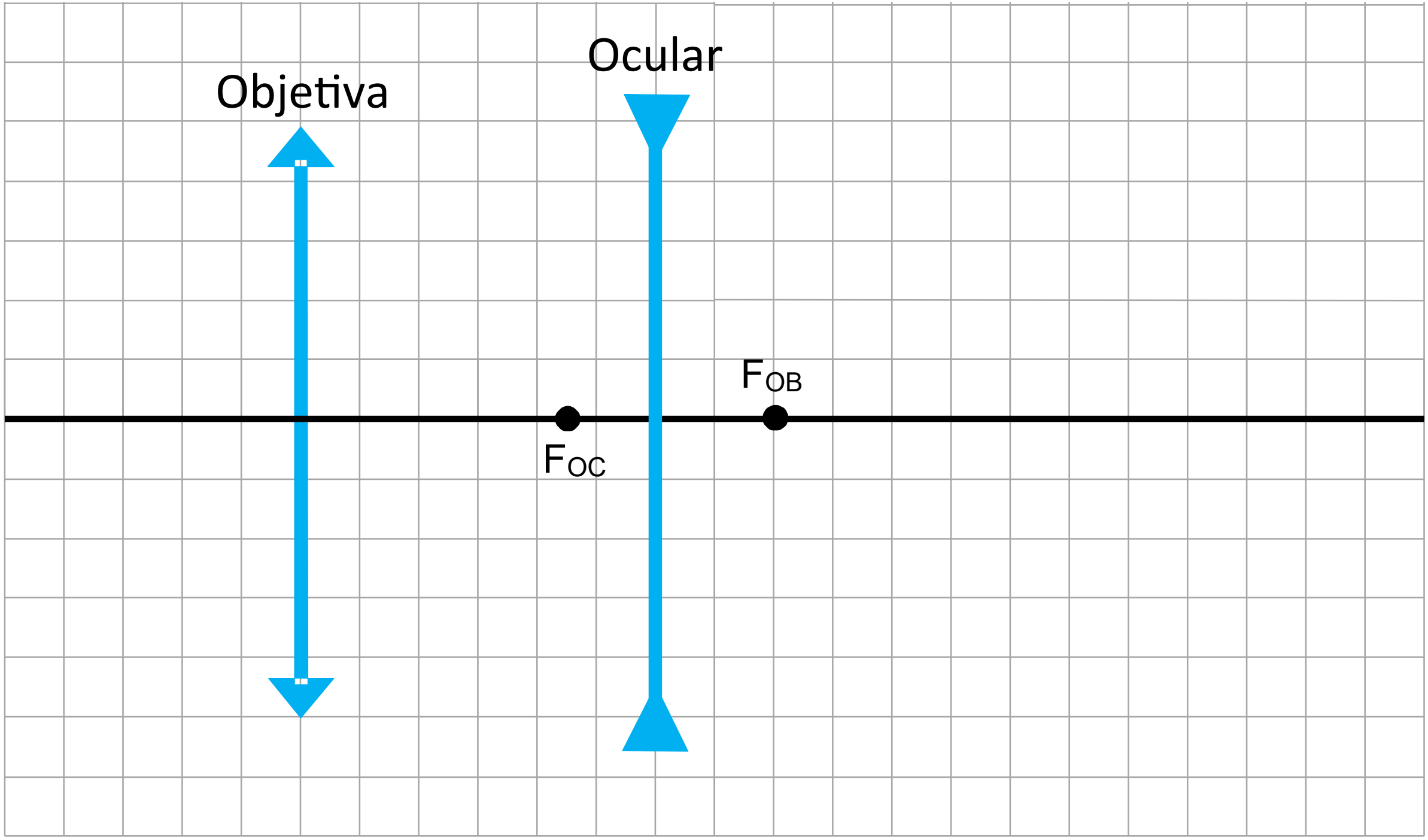
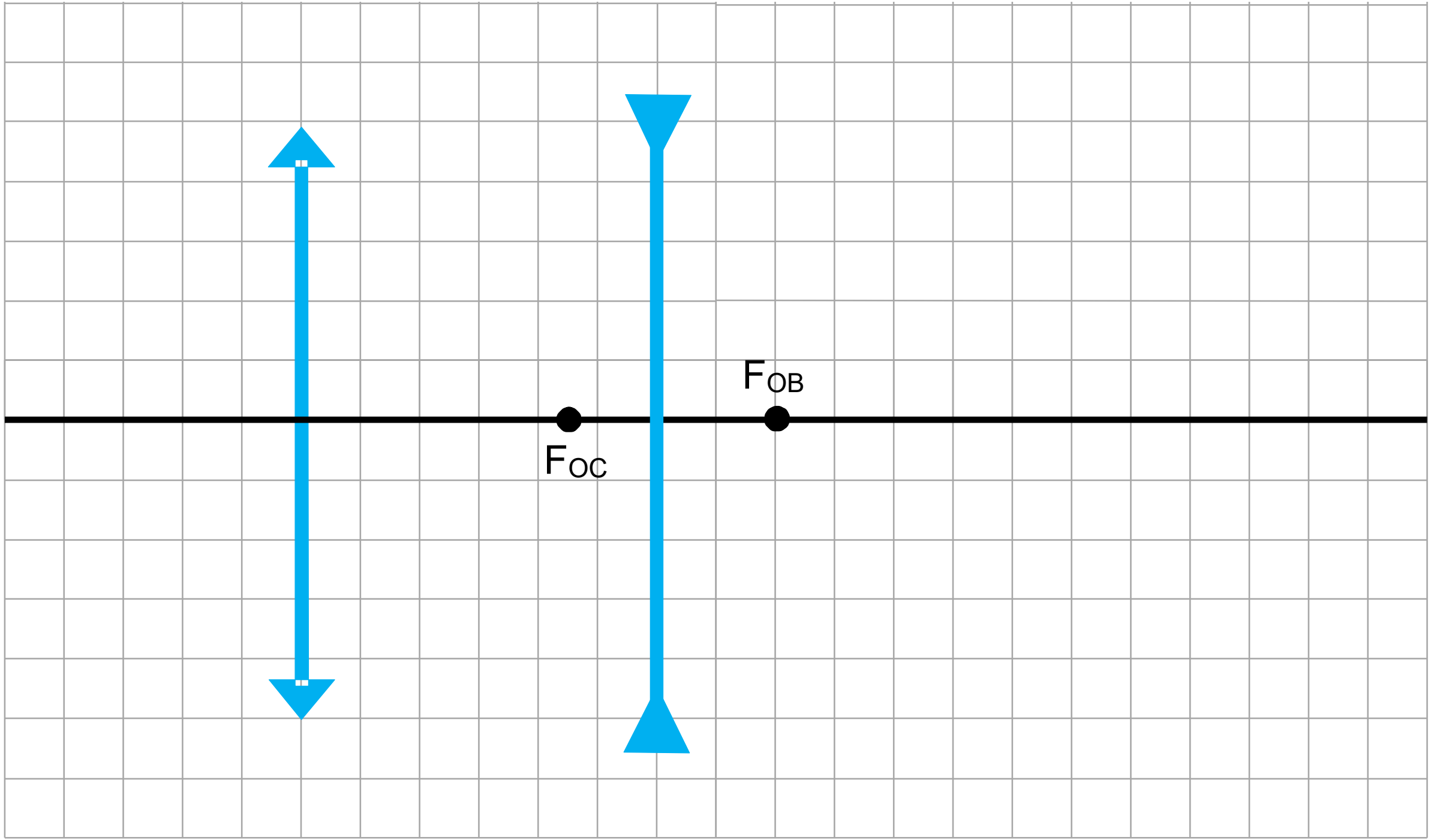
F_{OC}


Objetiva
Ocular
F_{OB}
F_{OC}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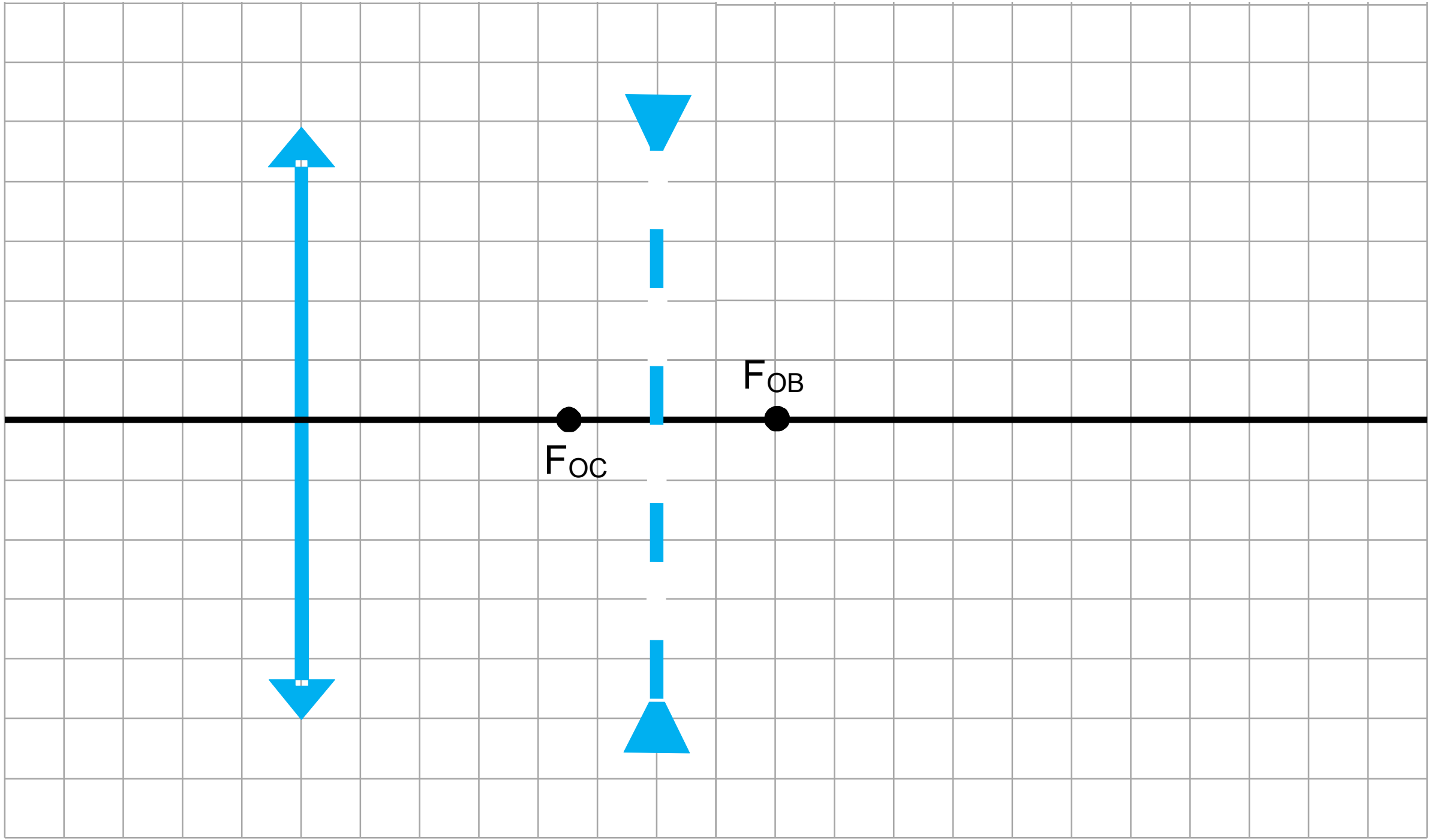
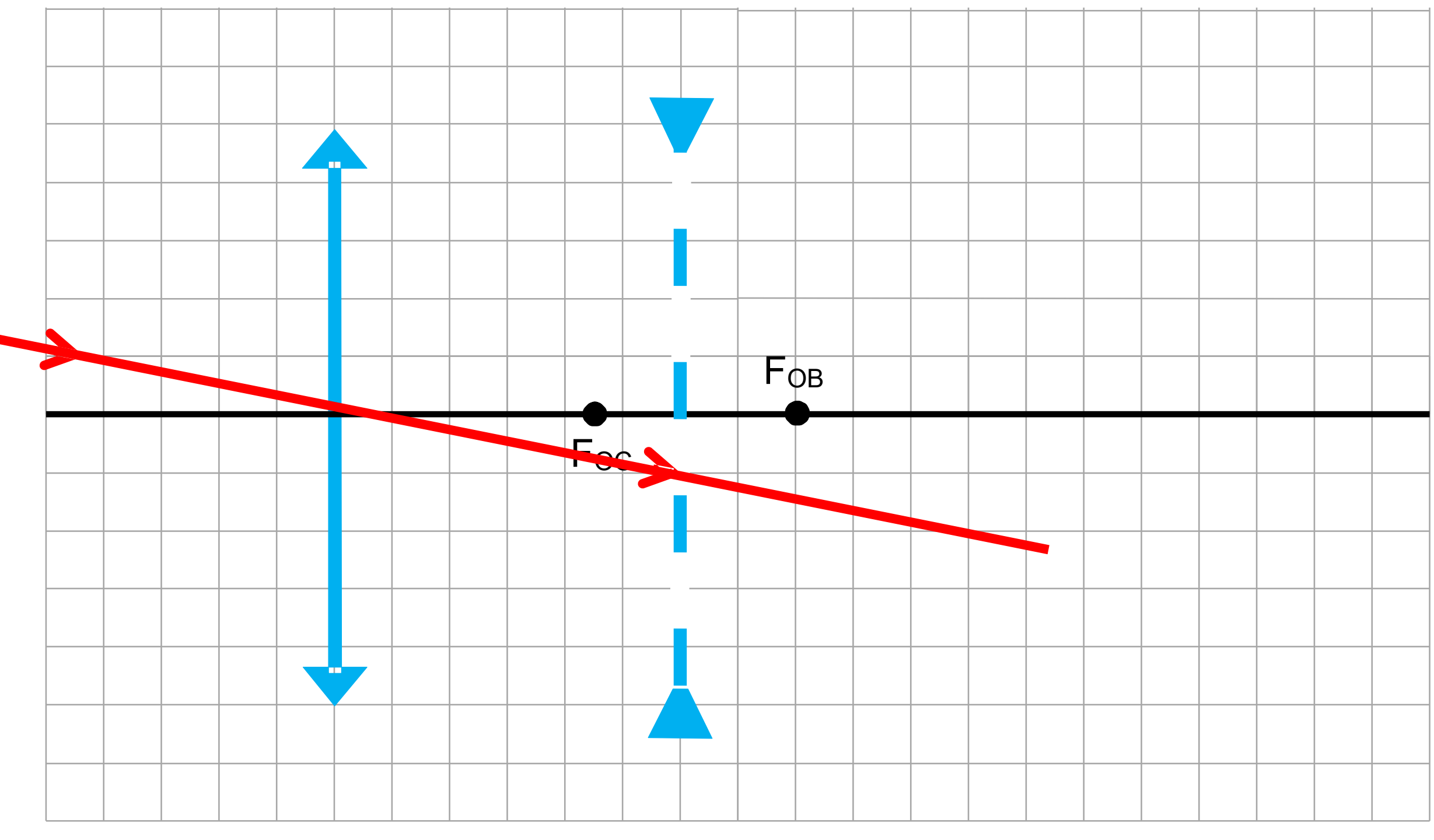
F_{OC}


F_{OB}
F_{OC}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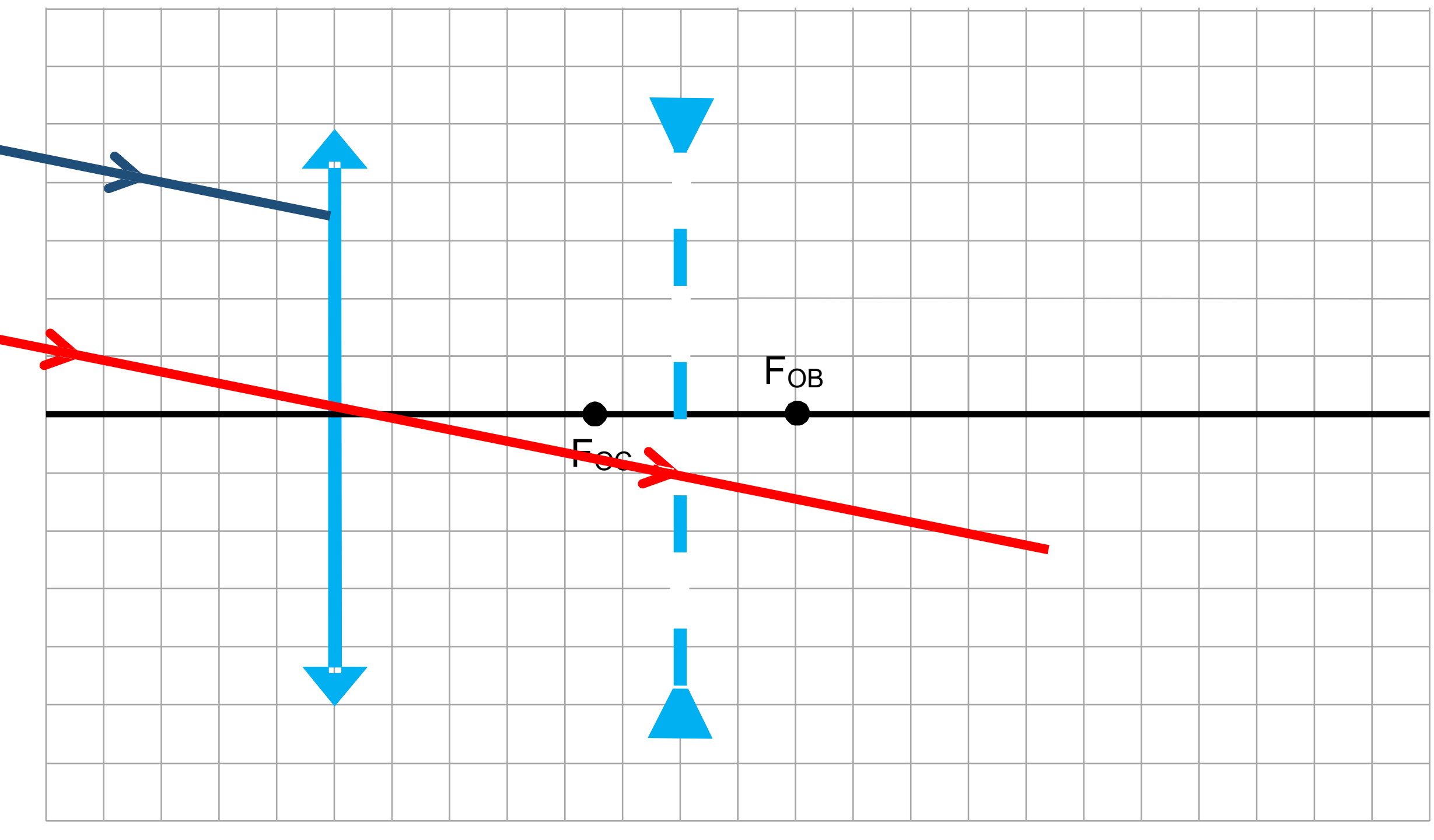
F_{OC}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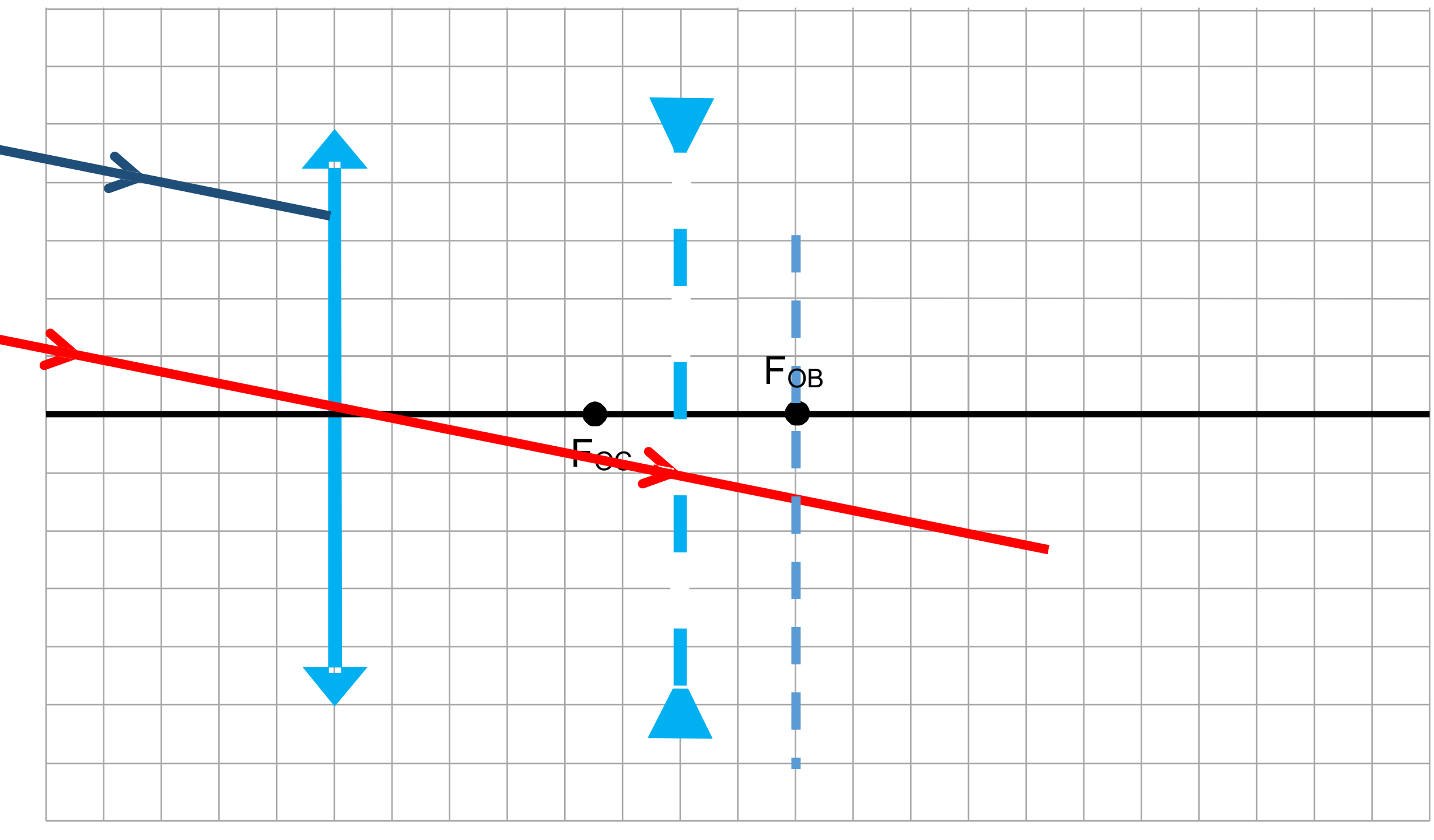
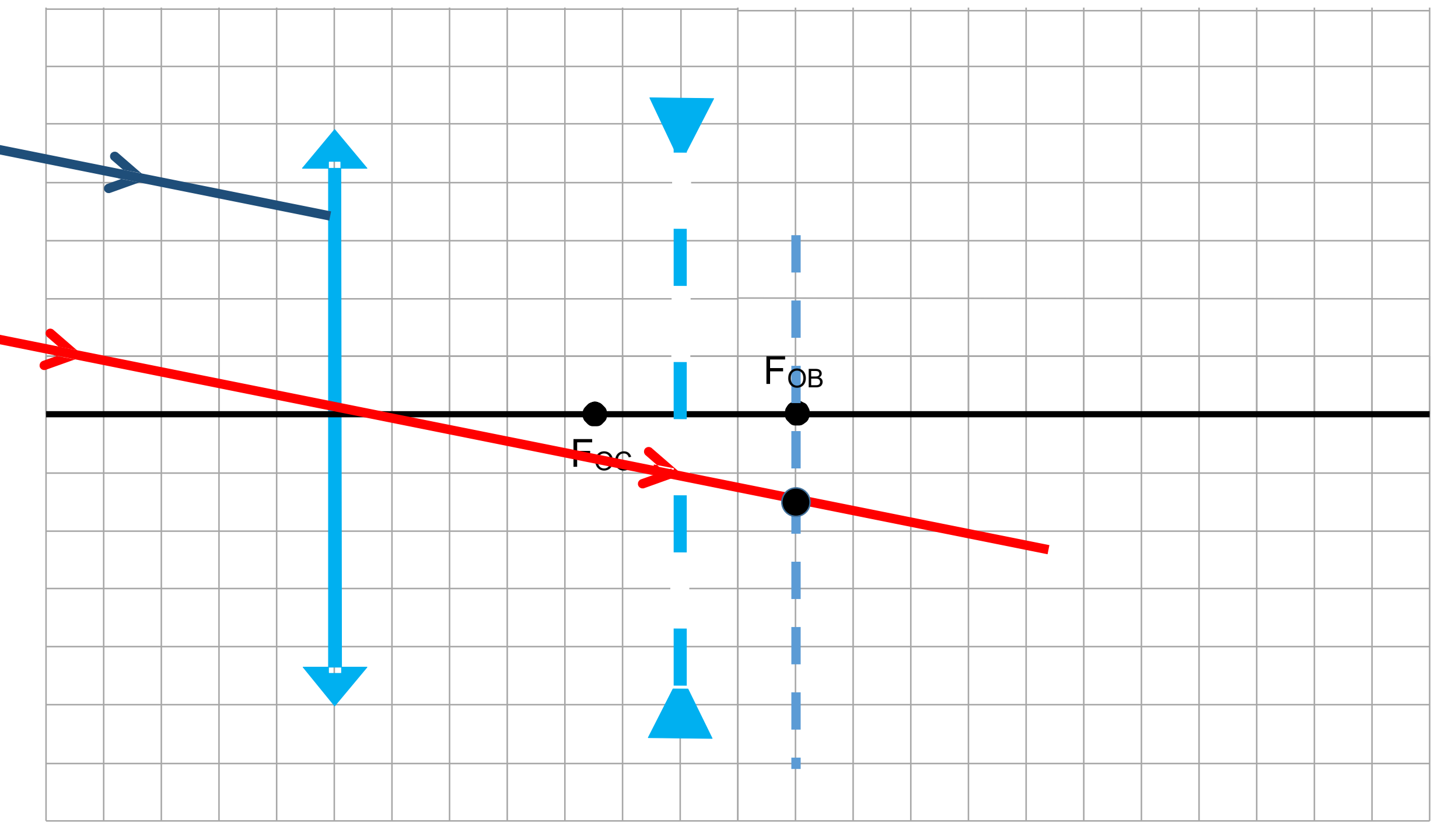

F_{OB}
F_{OC}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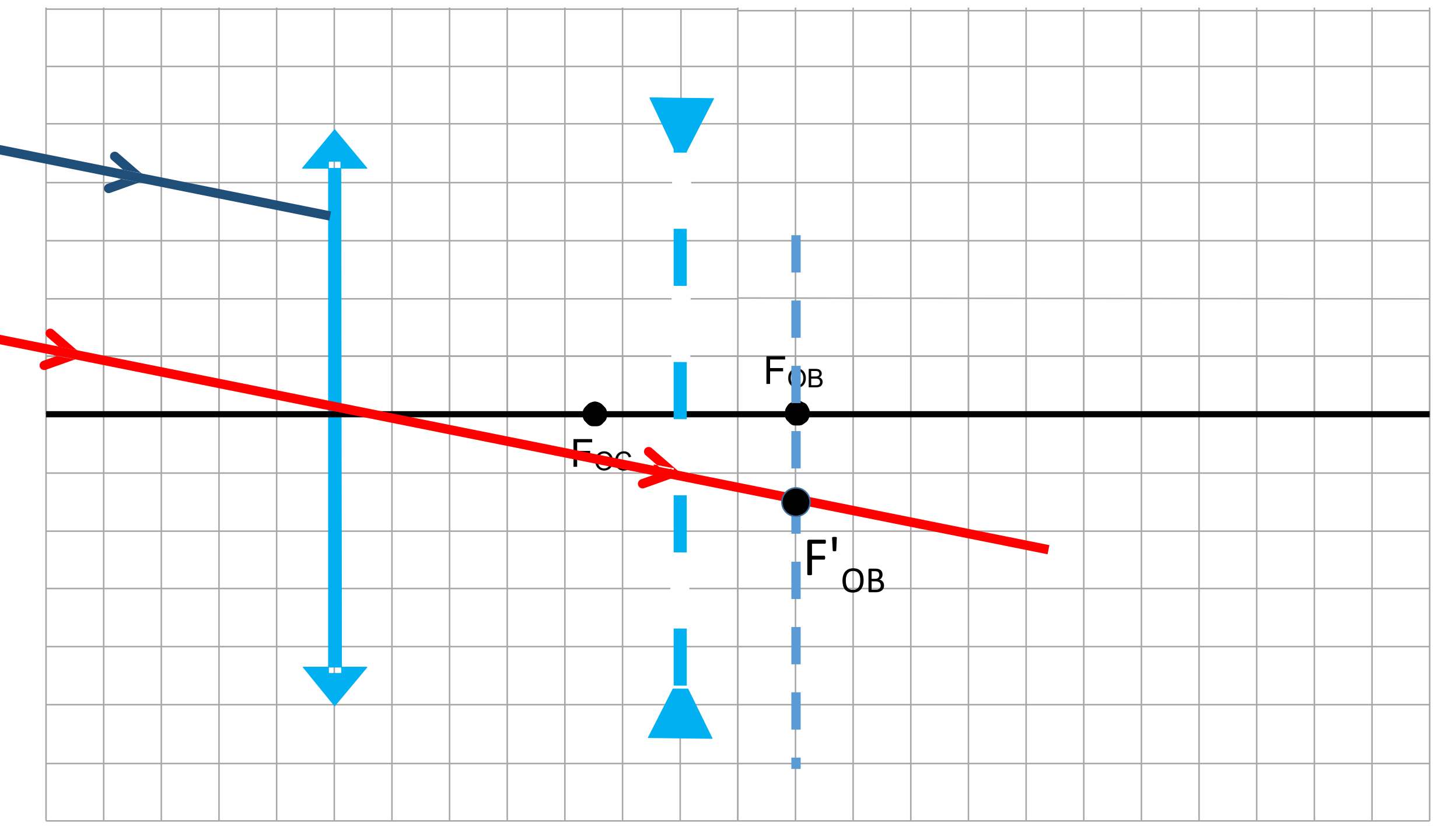
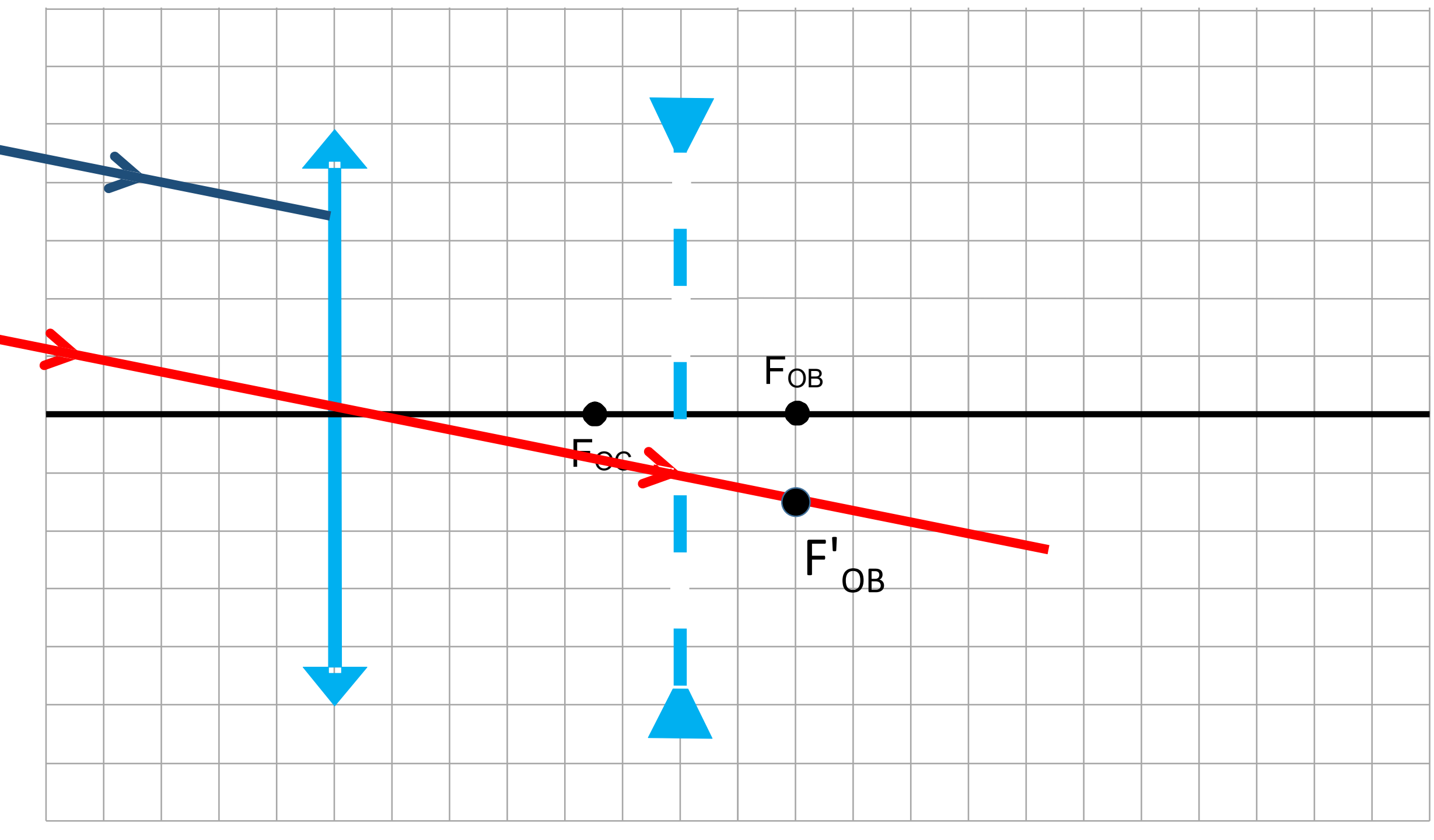

F OB
F OC
F' OB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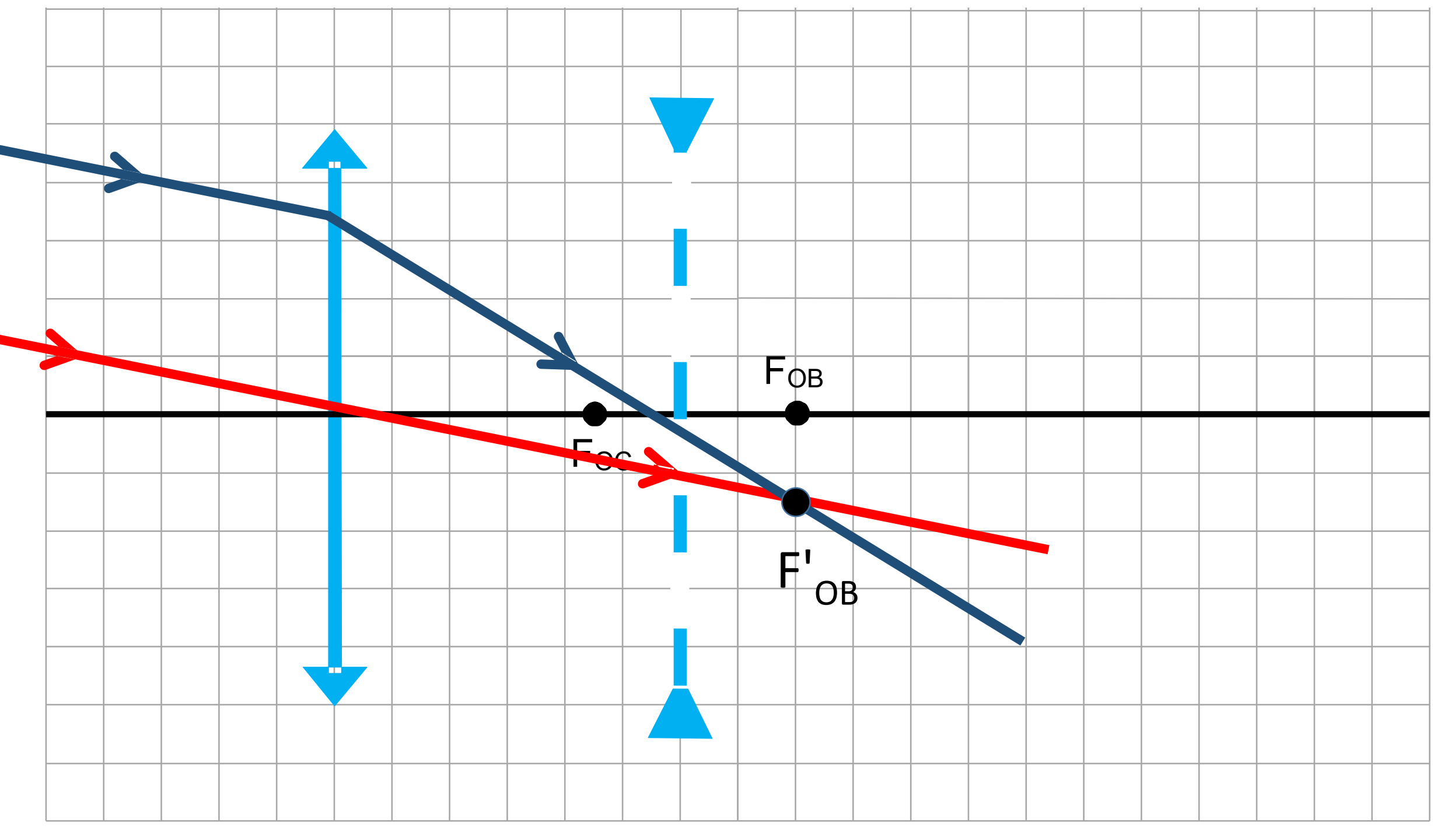
F'_{OB}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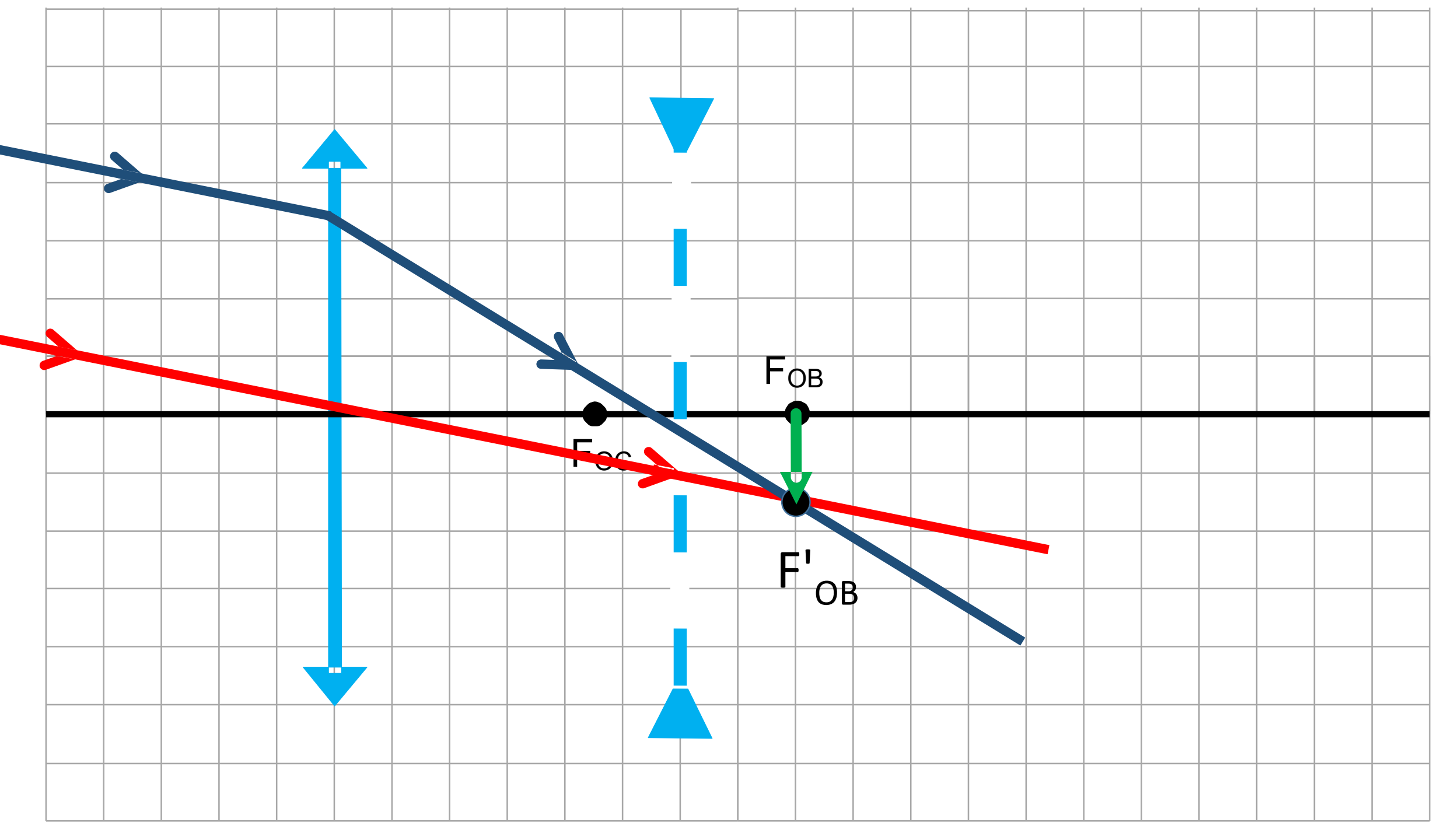
F_{OC}
F'_{OB}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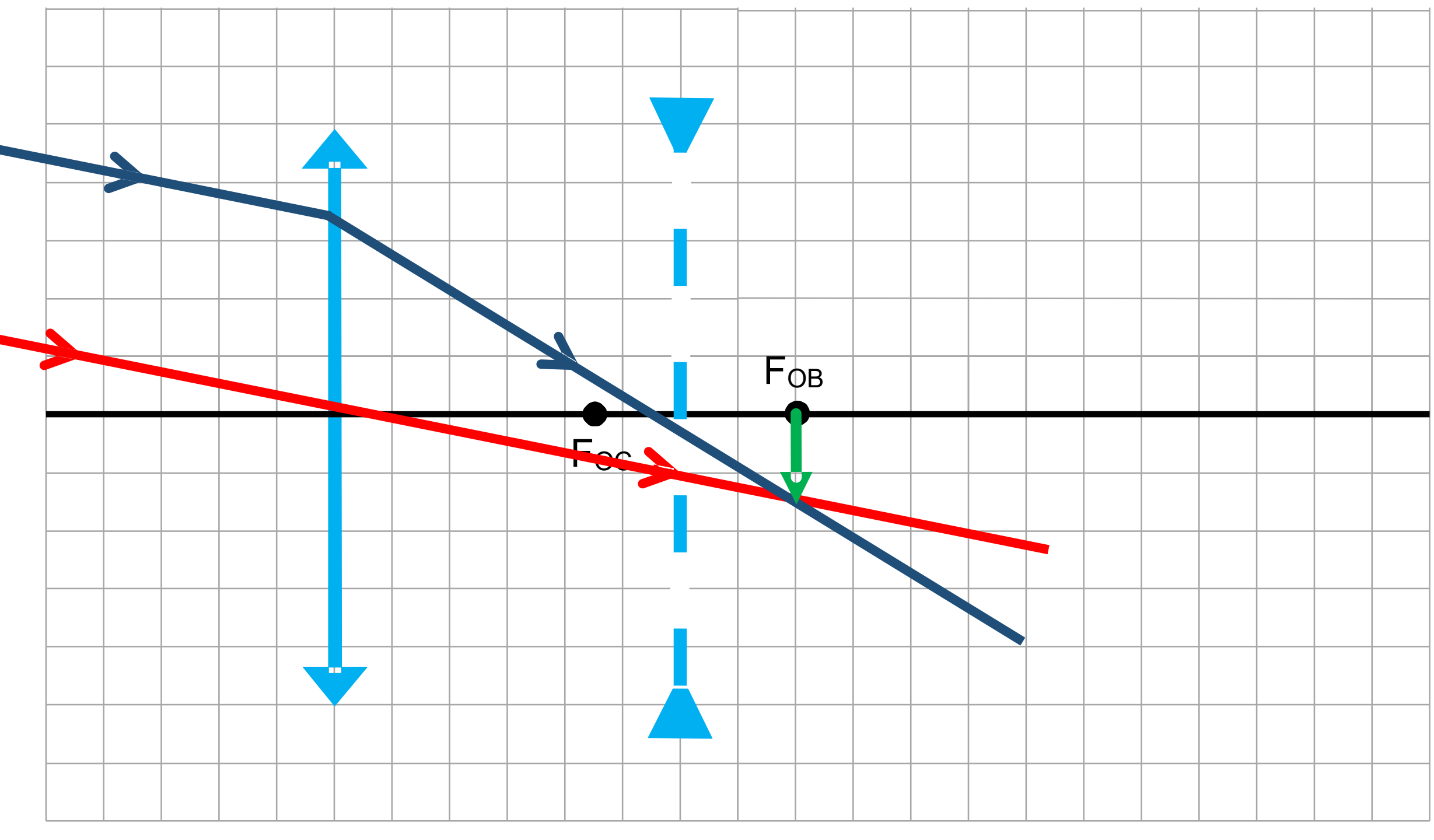
F_{OC}
F'_{OB}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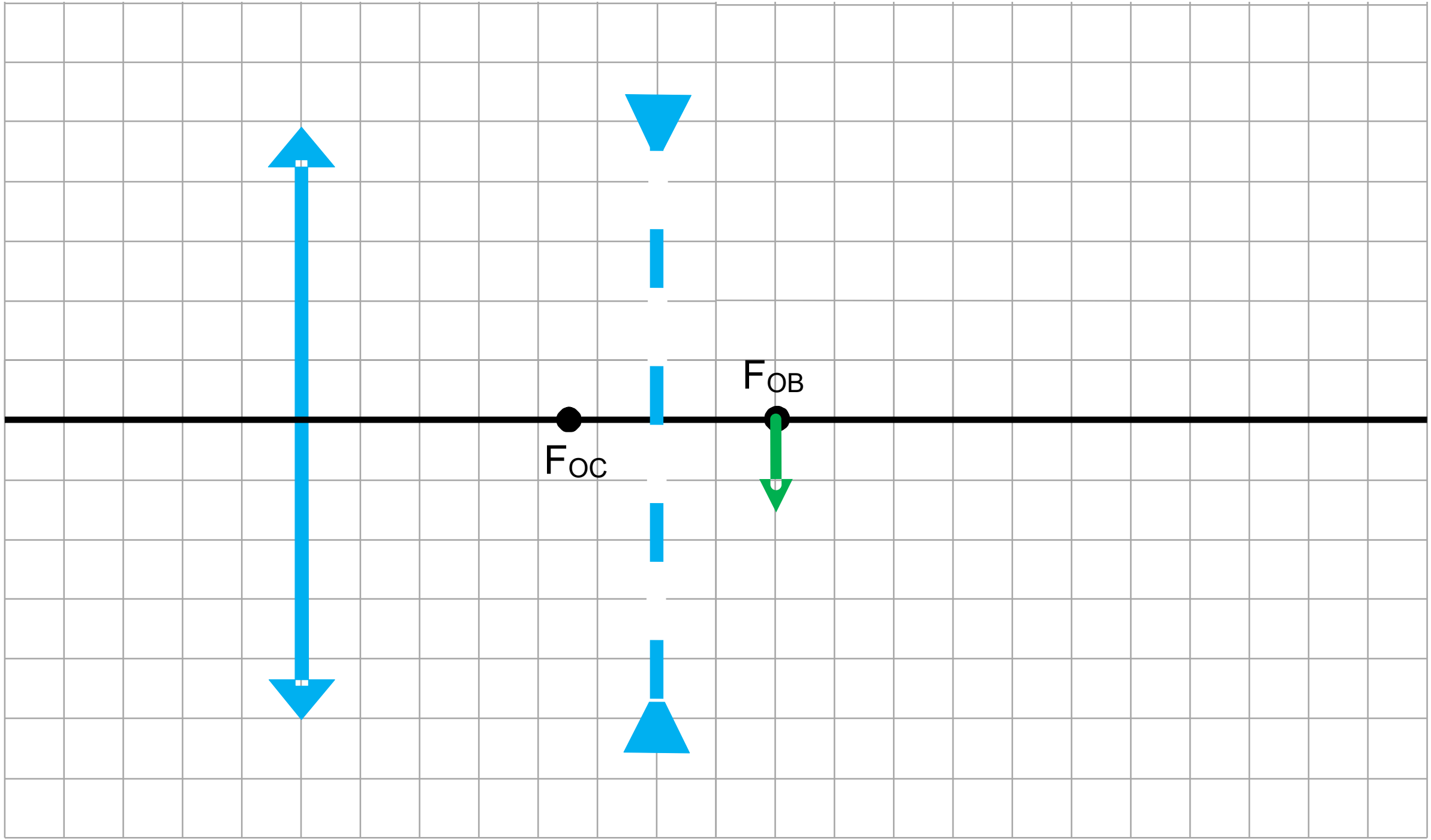
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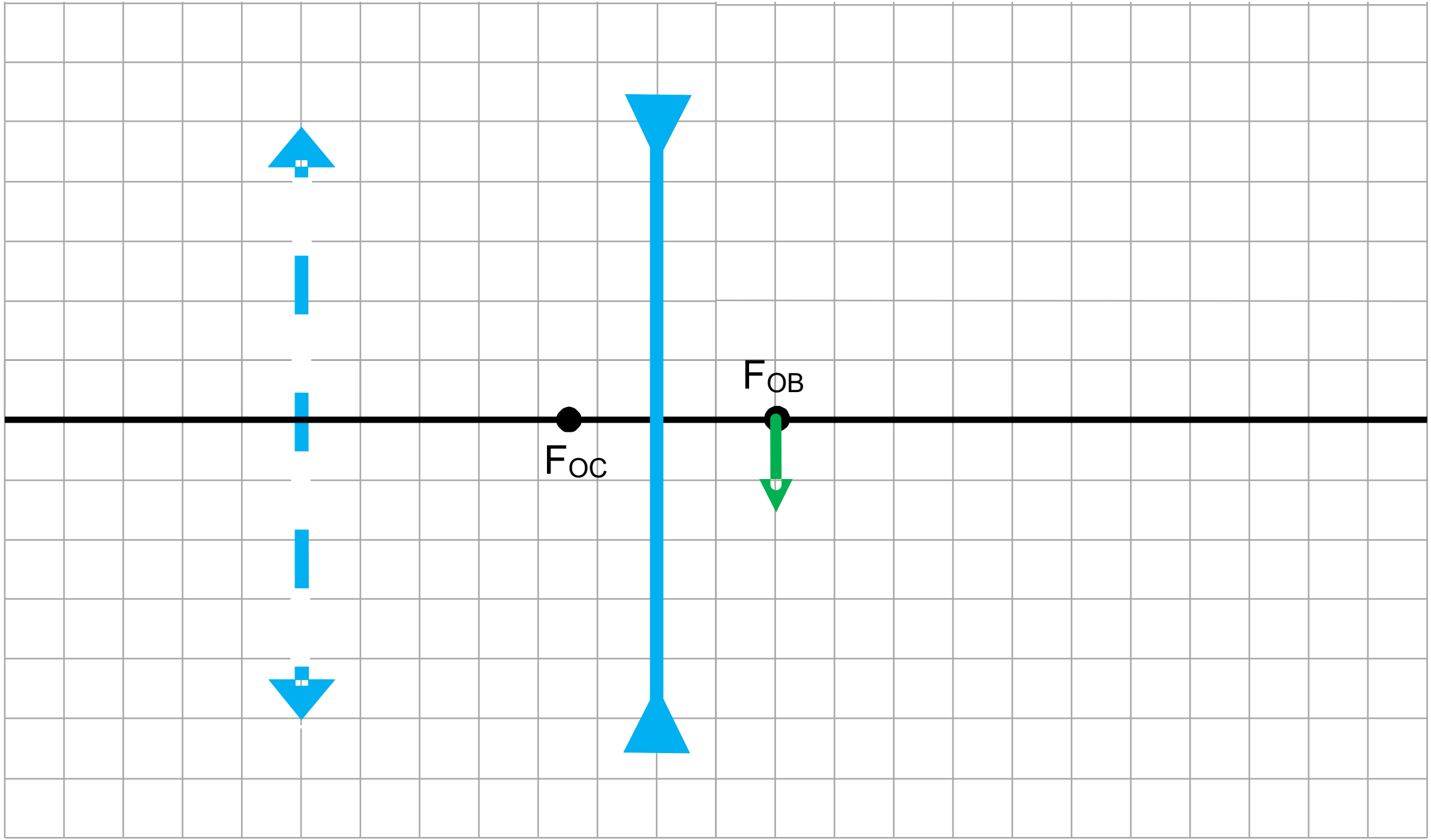
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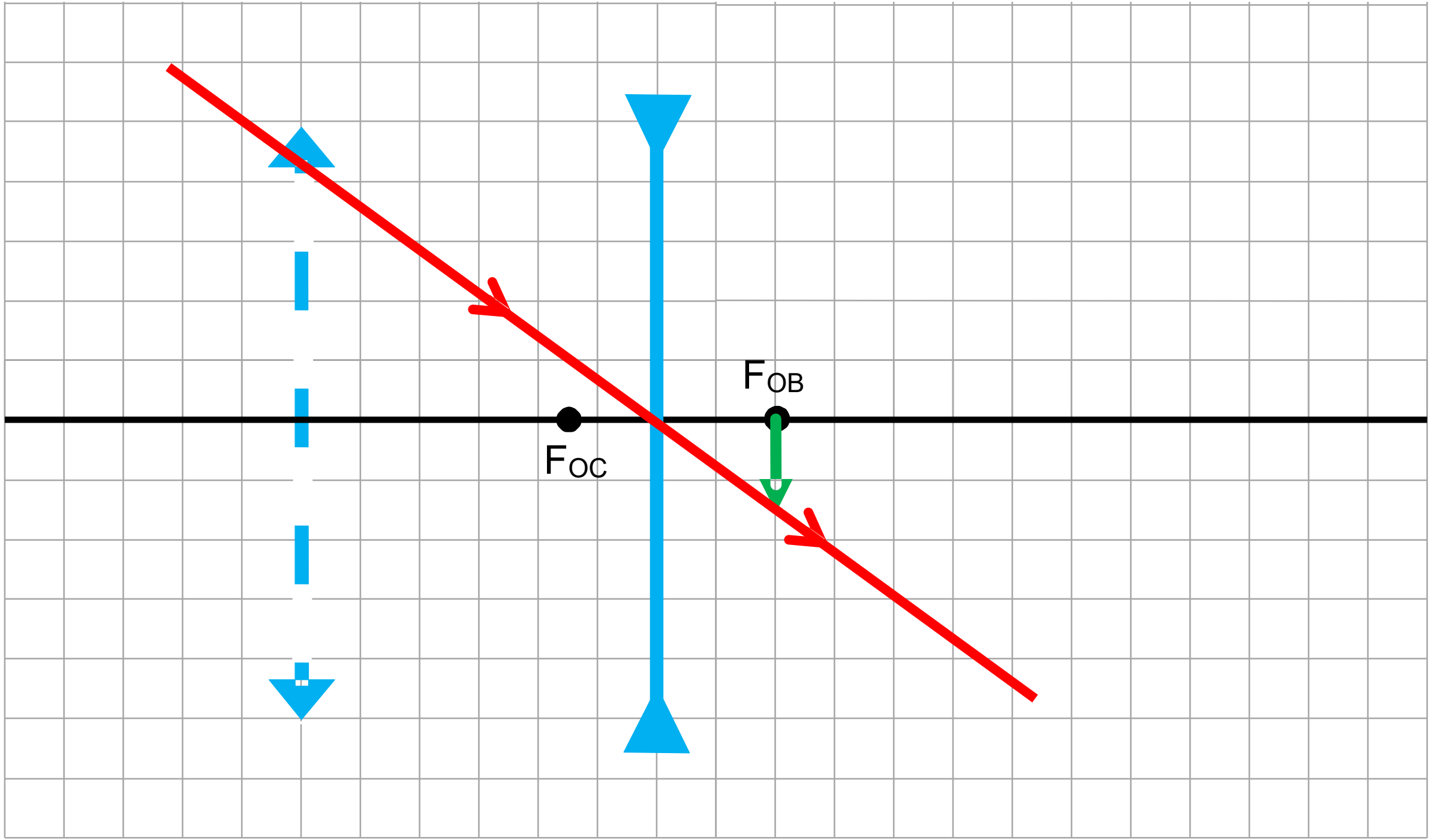
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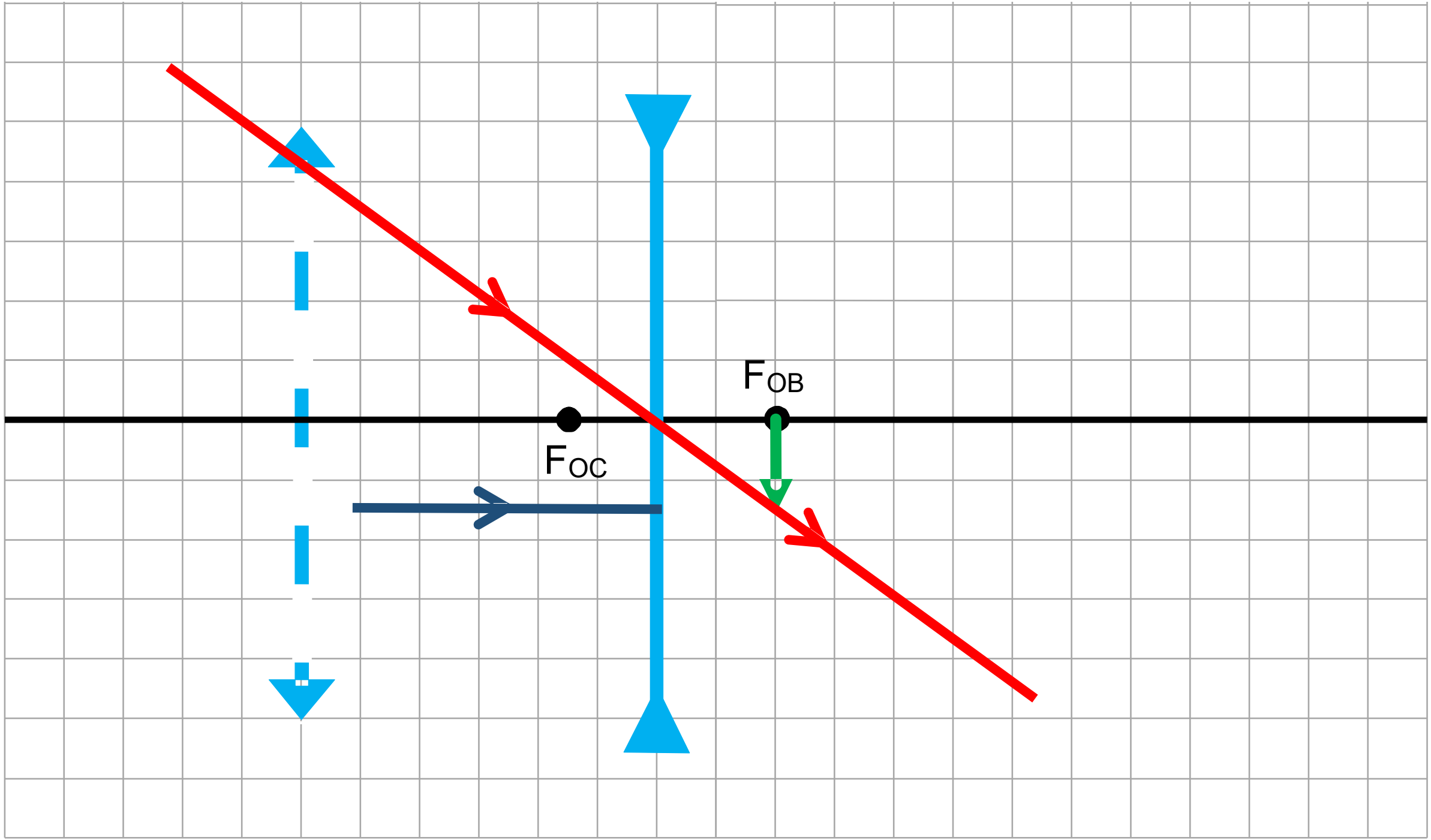
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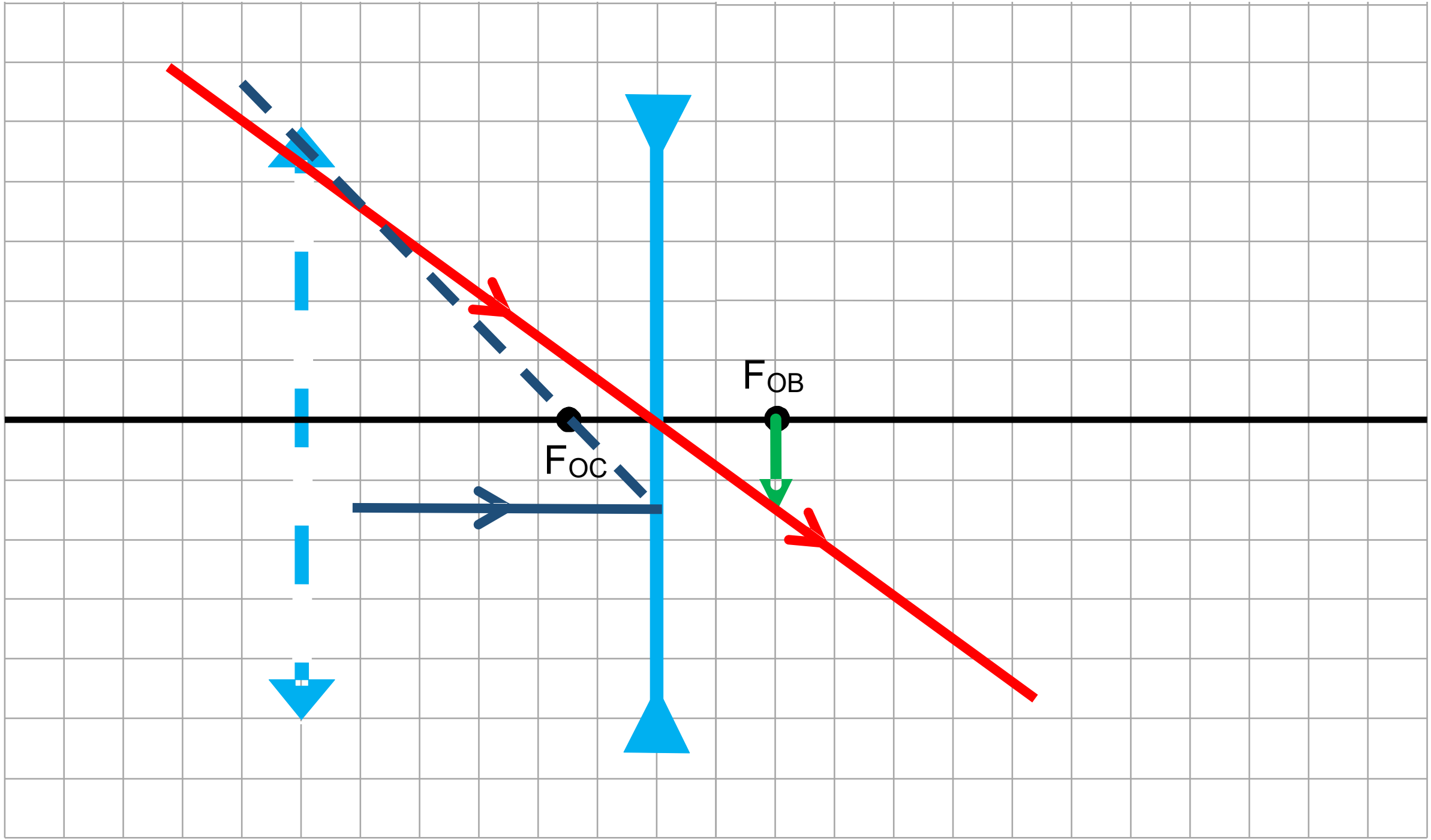
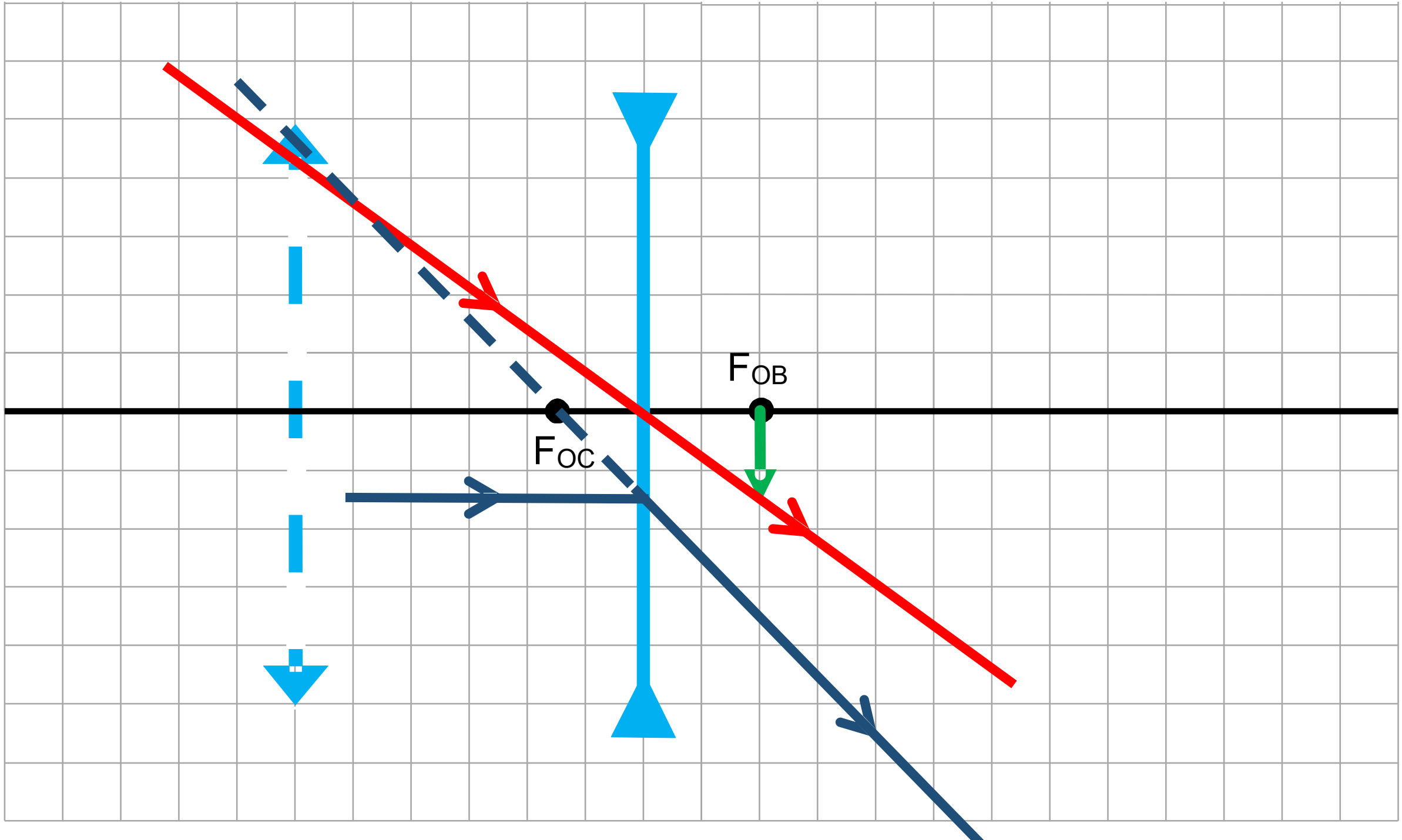
F_{OC}


F_{OB}
F_{OC}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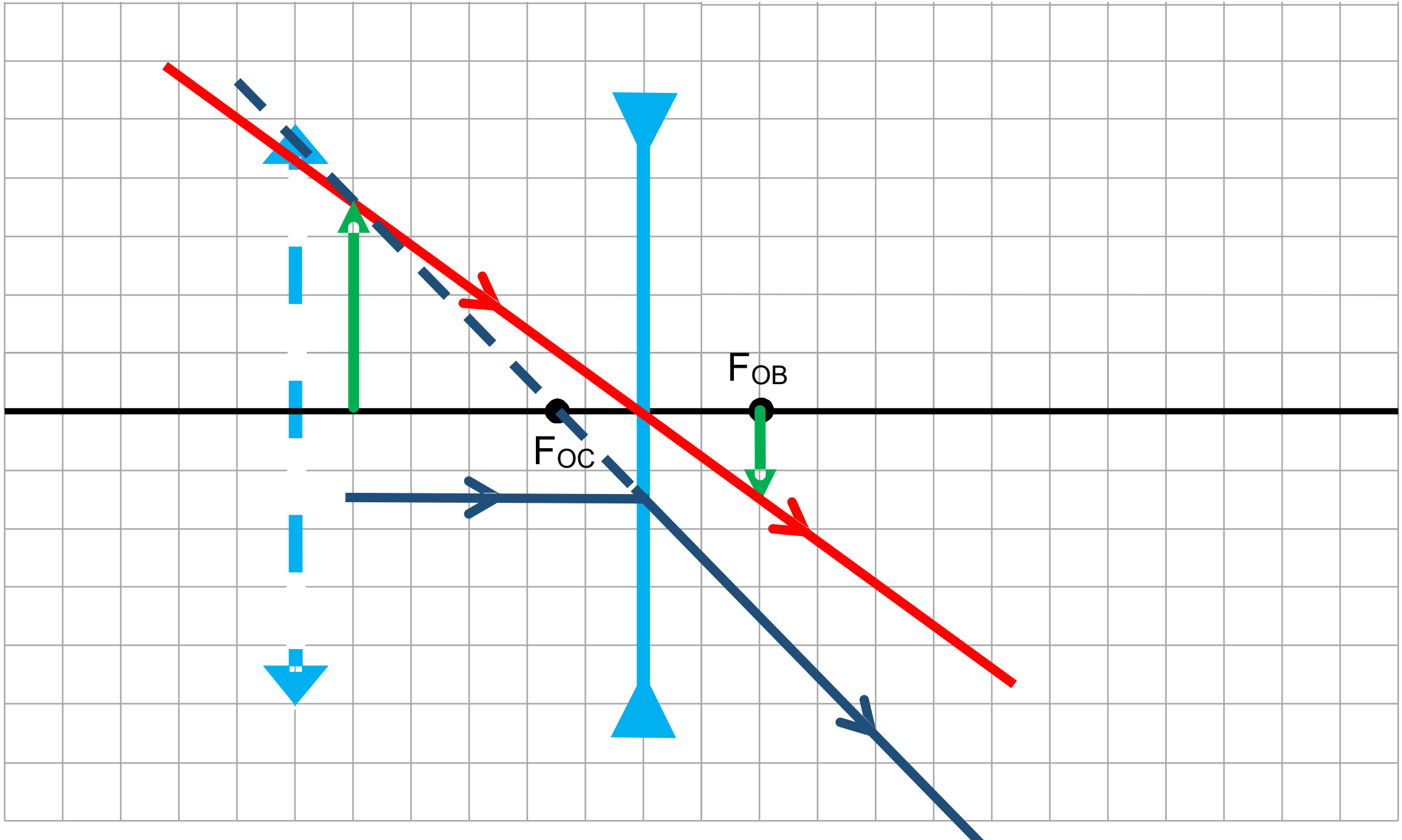
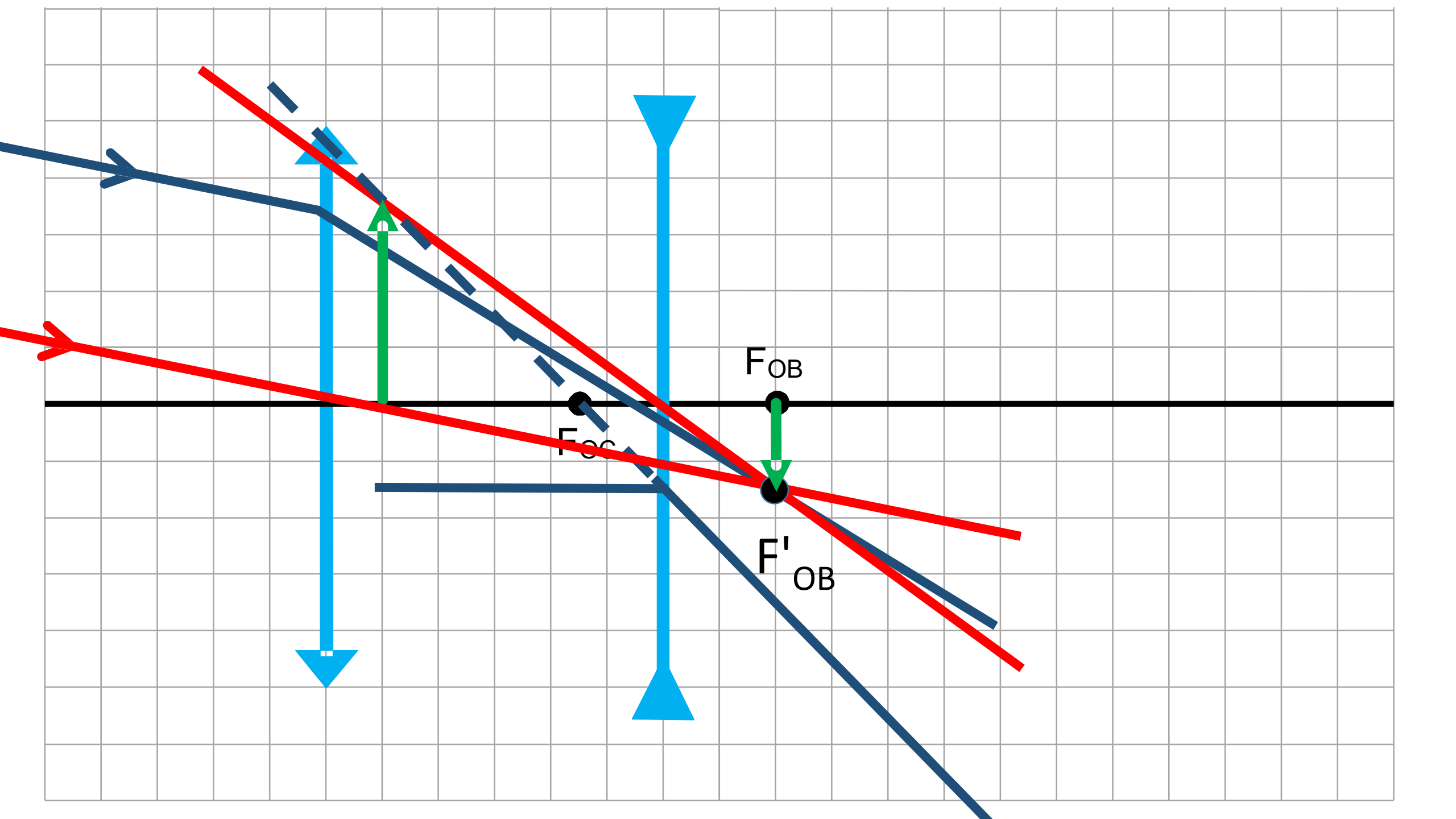
F_{OC}


F_{OB}
F_{OC}


F_{OB}
F'_{OB}

LUNETA TERRESTRE

LUNETA TERRESTRE

- IMAGEM:

LUNETA TERRESTRE

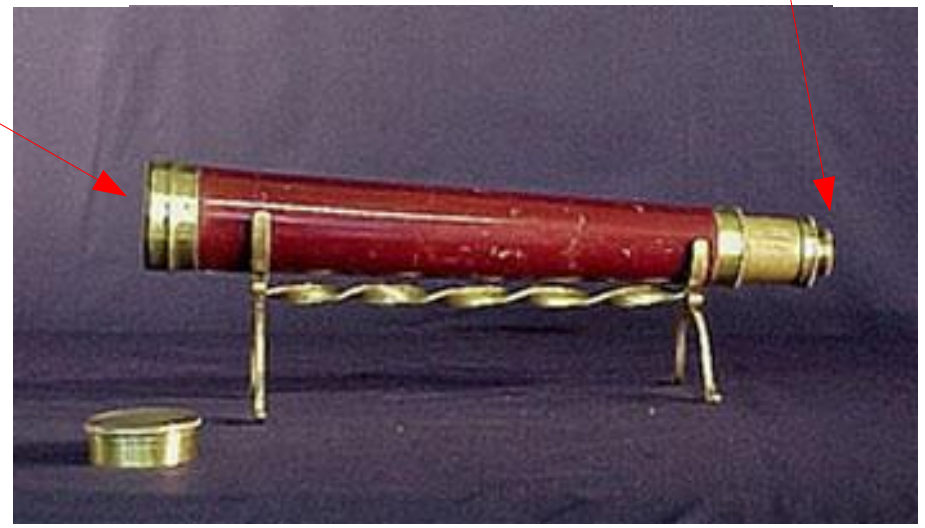
- IMAGEM:
  - VIRTUAL

LUNETA TERRESTRE

- IMAGEM:
  - VIRTUAL
  - DIREITA

LUNETA TERRESTRE

- IMAGEM:
  - VIRTUAL
  - DIREITA
  - QUANTO AO TAMANHO, DIZEMOS QUE HÁ UM AUMENTO ANGULAR, UMA VEZ QUE A IMAGEM FINAL É PONTUAL
  - É CHAMADA DE LUNETA TERRESTRE PELO FATO DE TER UMA IMAGEM FINAL DIREITA



Curiosidade: a luneta de Galileu (luneta terrestre) foi criada em 1609, portanto durante as grandes navegações (por exemplo, no descobrimento do Brasil, em 1500) ainda não existiam, portanto é falso dizer que ela foi usada no descobrimento do Brasil.

AUMENTO ANGULAR

Para que o aumento de uma luneta ou telescópio seja o máximo possível, o foco imagem da objetiva deve coincidir com o foco objeto da ocular. Assim, o comprimento L da luneta será:

$$L = f_{OB} + f_{OC}$$

Note que se a ocular for uma lente divergente, o comprimento total será menor que o foco da objetiva uma vez que $f_{OC} < 0$.

Por fim, nesta condição, o aumento angular será:

$$M = \frac{f_{OB}}{f_{OC}}$$