

Código de Alumno:

--	--	--	--	--	--	--	--

Duración: 30 minutos

Fecha: 10 de abril del 2026

Instrucciones: Complete sus respuestas *únicamente* dentro de los recuadros. No se permiten borradores. Trabaje con **4 decimales** salvo indicación contraria. La falta del código de alumno implica una calificación de **0**. Revise **ambas caras** de la hoja. El uso de lápiz **anula el derecho a reclamo**. Se permite únicamente calculadora científica de dos líneas no programable, mas no de apuntes.

1. **(10 pts)** Se estudia el ángulo de deflexión α de un rayo de luz al pasar cerca de un cuerpo masivo esféricamente simétrico. En la aproximación de campo débil de la relatividad general, dicho ángulo (en rad) se modela por,

$$\alpha = \frac{4GM}{bc^2},$$

donde M es la masa del cuerpo, b es el parámetro de impacto del rayo luminoso, G es la constante de gravitación universal y $c = 3 \times 10^8$ m/s es la velocidad de la luz (valor exacto). Considere los siguientes datos del problema:

- $G = (6.674 \times 10^{-11} \pm 1.5 \times 10^{-15}) \text{ m}^3/\text{kg.s}^2$
- $M = 1.989 \times 10^{30} \text{ kg} \pm 1\%$ y $b = 6.957 \times 10^8 \text{ m} \pm 1\%$

Use además, la conversión exacta $1 \text{ rad} = 206265 \text{ arcsec}$ y realice lo siguiente:

- a) **(1 pt)** Calcule la deflexión estimada (en arcsec), en notación científica

$\tilde{\alpha} =$ arcsec

- b) **(3 pts)** Escriba las expresiones matemáticas para la variación de la deflexión α con respecto a G , M y b ,

$\frac{\partial \alpha}{\partial G} =$, $\frac{\partial \alpha}{\partial M} =$, $\frac{\partial \alpha}{\partial b} =$

- c) **(3 pts)** Escriba las contribuciones (valores numéricos, en arcsec) del error de G , M y b en el error de α , en notación científica

$\left \frac{\partial \alpha}{\partial G} \right \Delta G = $ 	$\left \frac{\partial \alpha}{\partial b} \right \Delta b = $
$\left \frac{\partial \alpha}{\partial M} \right \Delta M = $ 	

- d) **(2 pts)** La deflexión real puede expresarse como (valores numéricos):

$\alpha =$ arcsec $\pm$ arcsec

- e) **(1 pt)** Indique qué variable (G , M o b) contribuye menos al error de α :

2. **(10 pts)** Se desea almacenar en memoria el valor del ángulo de deflexión gravitacional de un rayo de luz que pasa cerca de una estrella fuera de la vía láctea. Por convenio, tome el valor con signo negativo para indicar que la desviación ocurre hacia la masa que curva la trayectoria. Use el estándar IEEE-754 con precisión simple. Considere el siguiente número en base decimal:

$\alpha = -17.75$

Para ello realice lo siguiente:

- a) **(5 pts)** Determine, paso a paso, el número decimal α en base binaria y notación científica normalizada (no ignore el signo):

Case No.	Case Name	Case Type	Case Status	Case Date	Case Location	Case Description	Case Details	Case Notes	Case Comments	Case Actions
1	John Doe	Case 1	Open	2023-01-01	New York	Case 1 Description	Case 1 Details	Case 1 Notes	Case 1 Comments	Case 1 Actions
2	Jane Smith	Case 2	Closed	2023-01-02	California	Case 2 Description	Case 2 Details	Case 2 Notes	Case 2 Comments	Case 2 Actions
3	Bob Johnson	Case 3	Pending	2023-01-03	Texas	Case 3 Description	Case 3 Details	Case 3 Notes	Case 3 Comments	Case 3 Actions
4	Alice Brown	Case 4	Open	2023-01-04	Florida	Case 4 Description	Case 4 Details	Case 4 Notes	Case 4 Comments	Case 4 Actions
5	Charlie Davis	Case 5	Closed	2023-01-05	Illinois	Case 5 Description	Case 5 Details	Case 5 Notes	Case 5 Comments	Case 5 Actions
6	Diana Prince	Case 6	Pending	2023-01-06	Washington	Case 6 Description	Case 6 Details	Case 6 Notes	Case 6 Comments	Case 6 Actions
7	Frank Miller	Case 7	Open	2023-01-07	Ohio	Case 7 Description	Case 7 Details	Case 7 Notes	Case 7 Comments	Case 7 Actions
8	Grace Lee	Case 8	Closed	2023-01-08	Georgia	Case 8 Description	Case 8 Details	Case 8 Notes	Case 8 Comments	Case 8 Actions
9	Henry Wilson	Case 9	Pending	2023-01-09	Michigan	Case 9 Description	Case 9 Details	Case 9 Notes	Case 9 Comments	Case 9 Actions
10	Ivy White	Case 10	Open	2023-01-10	Arizona	Case 10 Description	Case 10 Details	Case 10 Notes	Case 10 Comments	Case 10 Actions
11	Jack Black	Case 11	Closed	2023-01-11	Colorado	Case 11 Description	Case 11 Details	Case 11 Notes	Case 11 Comments	Case 11 Actions
12	Karen Green	Case 12	Pending	2023-01-12	Connecticut	Case 12 Description	Case 12 Details	Case 12 Notes	Case 12 Comments	Case 12 Actions
13	Liam King	Case 13	Open	2023-01-13	Delaware	Case 13 Description	Case 13 Details	Case 13 Notes	Case 13 Comments	Case 13 Actions
14	Mia Queen	Case 14	Closed	2023-01-14	District of Columbia	Case 14 Description	Case 14 Details	Case 14 Notes	Case 14 Comments	Case 14 Actions
15	Noah Scott	Case 15	Pending	2023-01-15	Idaho	Case 15 Description	Case 15 Details	Case 15 Notes	Case 15 Comments	Case 15 Actions
16	Olivia Taylor	Case 16	Open	2023-01-16	Indiana	Case 16 Description	Case 16 Details	Case 16 Notes	Case 16 Comments	Case 16 Actions
17	Peter Hall	Case 17	Closed	2023-01-17	Iowa	Case 17 Description	Case 17 Details	Case 17 Notes	Case 17 Comments	Case 17 Actions
18	Quinn Adams	Case 18	Pending	2023-01-18	Kansas	Case 18 Description	Case 18 Details	Case 18 Notes	Case 18 Comments	Case 18 Actions
19	Ryan Baker	Case 19	Open	2023-01-19	Kentucky	Case 19 Description	Case 19 Details	Case 19 Notes	Case 19 Comments	Case 19 Actions
20	Sarah Carter	Case 20	Closed	2023-01-20	Louisiana	Case 20 Description	Case 20 Details	Case 20 Notes	Case 20 Comments	Case 20 Actions
21	Timothy Evans	Case 21	Pending	2023-01-21	Maine	Case 21 Description	Case 21 Details	Case 21 Notes	Case 21 Comments	Case 21 Actions
22	Uma Garcia	Case 22	Open	2023-01-22	Maryland	Case 22 Description	Case 22 Details	Case 22 Notes	Case 22 Comments	Case 22 Actions
23	Victor Harris	Case 23	Closed	2023-01-23	Massachusetts	Case 23 Description	Case 23 Details	Case 23 Notes	Case 23 Comments	Case 23 Actions
24	Wendy Ives	Case 24	Pending	2023-01-24	Minnesota	Case 24 Description	Case 24 Details	Case 24 Notes	Case 24 Comments	Case 24 Actions
25	Xavier Jones	Case 25	Open	2023-01-25	Mississippi	Case 25 Description	Case 25 Details	Case 25 Notes	Case 25 Comments	Case 25 Actions
26	Yara King	Case 26	Closed	2023-01-26	Missouri	Case 26 Description	Case 26 Details	Case 26 Notes	Case 26 Comments	Case 26 Actions
27	Zoe Lee	Case 27	Pending	2023-01-27	Montana	Case 27 Description	Case 27 Details	Case 27 Notes	Case 27 Comments	Case 27 Actions
28	Adam Miller	Case 28	Open	2023-01-28	Nebraska	Case 28 Description	Case 28 Details	Case 28 Notes	Case 28 Comments	Case 28 Actions
29	Bella Prince	Case 29	Closed	2023-01-29	Nevada	Case 29 Description	Case 29 Details	Case 29 Notes	Case 29 Comments	Case 29 Actions
30	Chris Scott	Case 30	Pending	2023-01-30	New Hampshire	Case 30 Description	Case 30 Details	Case 30 Notes	Case 30 Comments	Case 30 Actions
31	Diana Taylor	Case 31	Open	2023-01-31	New Jersey	Case 31 Description	Case 31 Details	Case 31 Notes	Case 31 Comments	Case 31 Actions
32	Ethan White	Case 32	Closed	2023-02-01	New Mexico	Case 32 Description	Case 32 Details	Case 32 Notes	Case 32 Comments	Case 32 Actions
33	Fiona Black	Case 33	Pending	2023-02-02	New York	Case 33 Description	Case 33 Details	Case 33 Notes	Case 33 Comments	Case 33 Actions
34	George Green	Case 34	Open	2023-02-03	North Carolina	Case 34 Description	Case 34 Details	Case 34 Notes	Case 34 Comments	Case 34 Actions
35	Hannah King	Case 35	Closed	2023-02-04	North Dakota	Case 35 Description	Case 35 Details	Case 35 Notes	Case 35 Comments	Case 35 Actions
36	Ivan Lee	Case 36	Pending	2023-02-05	Ohio	Case 36 Description	Case 36 Details	Case 36 Notes	Case 36 Comments	Case 36 Actions
37	Jessica Miller	Case 37	Open	2023-02-06	Oklahoma	Case 37 Description	Case 37 Details	Case 37 Notes	Case 37 Comments	Case 37 Actions
38	Kyle Prince	Case 38	Closed	2023-02-07	Oregon	Case 38 Description	Case 38 Details	Case 38 Notes	Case 38 Comments	Case 38 Actions
39	Laura Scott	Case 39	Pending	2023-02-08	Pennsylvania	Case 39 Description				

- b) **(3 pts)** Determine el exponente interno y la mantisa fraccionaria almacenadas en base binaria con precisión simple (float32).

Case No.	Case Name	Case Type	Case Status	Case Date	Case Location	Case Description	Case Notes	Case Attachments
1	John Doe	Medical	Open	2023-01-01	New York	John Doe, 45 years old, male, reported a sudden onset of chest pain and shortness of breath on 2023-01-01. He was taken to the hospital and diagnosed with a heart attack. He is currently recovering in the hospital.	John Doe has a history of high blood pressure and cholesterol. He was last seen by a doctor on 2022-12-15. He was prescribed medication for his blood pressure and cholesterol.	John Doe's medical records from 2022-12-15 are attached.
2	Jane Smith	Medical	Closed	2023-01-02	California	Jane Smith, 32 years old, female, reported a sudden onset of abdominal pain and nausea on 2023-01-02. She was taken to the hospital and diagnosed with a stomach ulcer. She is currently recovering in the hospital.	Jane Smith has a history of stomach ulcers. She was last seen by a doctor on 2022-12-10. She was prescribed medication for her stomach ulcer.	Jane Smith's medical records from 2022-12-10 are attached.
3	Michael Brown	Medical	Open	2023-01-03	Texas	Michael Brown, 58 years old, male, reported a sudden onset of chest pain and shortness of breath on 2023-01-03. He was taken to the hospital and diagnosed with a heart attack. He is currently recovering in the hospital.	Michael Brown has a history of high blood pressure and cholesterol. He was last seen by a doctor on 2022-12-20. He was prescribed medication for his blood pressure and cholesterol.	Michael Brown's medical records from 2022-12-20 are attached.
4	Sarah Johnson	Medical	Closed	2023-01-04	Florida	Sarah Johnson, 28 years old, female, reported a sudden onset of abdominal pain and nausea on 2023-01-04. She was taken to the hospital and diagnosed with a stomach ulcer. She is currently recovering in the hospital.	Sarah Johnson has a history of stomach ulcers. She was last seen by a doctor on 2022-12-18. She was prescribed medication for her stomach ulcer.	Sarah Johnson's medical records from 2022-12-18 are attached.
5	David Wilson	Medical	Open	2023-01-05	Illinois	David Wilson, 65 years old, male, reported a sudden onset of chest pain and shortness of breath on 2023-01-05. He was taken to the hospital and diagnosed with a heart attack. He is currently recovering in the hospital.	David Wilson has a history of high blood pressure and cholesterol. He was last seen by a doctor on 2022-12-25. He was prescribed medication for his blood pressure and cholesterol.	David Wilson's medical records from 2022-12-25 are attached.
6	Emily Davis	Medical	Closed	2023-01-06	Ohio	Emily Davis, 35 years old, female, reported a sudden onset of abdominal pain and nausea on 2023-01-06. She was taken to the hospital and diagnosed with a stomach ulcer. She is currently recovering in the hospital.	Emily Davis has a history of stomach ulcers. She was last seen by a doctor on 2022-12-22. She was prescribed medication for her stomach ulcer.	Emily Davis's medical records from 2022-12-22 are attached.
7	Robert Miller	Medical	Open	2023-01-07	Georgia	Robert Miller, 52 years old, male, reported a sudden onset of chest pain and shortness of breath on 2023-01-07. He was taken to the hospital and diagnosed with a heart attack. He is currently recovering in the hospital.	Robert Miller has a history of high blood pressure and cholesterol. He was last seen by a doctor on 2022-12-28. He was prescribed medication for his blood pressure and cholesterol.	Robert Miller's medical records from 2022-12-28 are attached.
8	Lisa Anderson	Medical	Closed	2023-01-08	Arizona	Lisa Anderson, 30 years old, female, reported a sudden onset of abdominal pain and nausea on 2023-01-08. She was taken to the hospital and diagnosed with a stomach ulcer. She is currently recovering in the hospital.	Lisa Anderson has a history of stomach ulcers. She was last seen by a doctor on 2022-12-24. She was prescribed medication for her stomach ulcer.	Lisa Anderson's medical records from 2022-12-24 are attached.
9	Christopher Taylor	Medical	Open	2023-01-09	Colorado	Christopher Taylor, 60 years old, male, reported a sudden onset of chest pain and shortness of breath on 2023-01-09. He was taken to the hospital and diagnosed with a heart attack. He is currently recovering in the hospital.	Christopher Taylor has a history of high blood pressure and cholesterol. He was last seen by a doctor on 2022-12-30. He was prescribed medication for his blood pressure and cholesterol.	Christopher Taylor's medical records from 2022-12-30 are attached.
10	Amanda White	Medical	Closed	2023-01-10	Idaho	Amanda White, 38 years old, female, reported a sudden onset of abdominal pain and nausea on 2023-01-10. She was taken to the hospital and diagnosed with a stomach ulcer. She is currently recovering in the hospital.	Amanda White has a history of stomach ulcers. She was last seen by a doctor on 2022-12-26. She was prescribed medication for her stomach ulcer.	Amanda White's medical records from 2022-12-26 are attached.

- c) **(2 pts)** Represente el número α en el estándar IEEE-754 con precisión simple (la cadena completa será considerada como una única respuesta).

$\alpha_{\text{IEEE-754}} =$

[illegible]