

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 $c = 3 \times 10^8 \text{ m/s}$ es la velocidad de la luz (valor exacto). Considere los siguientes datos del problema:

- $G = (6.674 \times 10^{-11} \pm 1.5 \times 10^{-15}) \text{ m}^3/\text{kg}\cdot\text{s}^2$
- $M = 1.935 \times 10^{30} \text{ kg} \pm 1 \%$ $b = 6.953 \times 10^8 \text{ m} \pm 1.2 \%$

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

$$\tilde{\alpha} = \boxed{} \text{ arcsec}$$

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

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

- 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

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

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

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

$$\alpha = \boxed{} \text{ arcsec} \pm \boxed{} \text{ arcsec}$$

- 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 exótica. Por convenio, se toma el valor con signo positivo para indicar que la desviación ocurre alejándose de la masa que curva la trayectoria. Use el estándar IEEE-754 con precisión simple. Considere el siguiente número en base decimal:

$\alpha = +21.75$

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 Address	Case City	Case State	Case Zip	Case Phone	Case Email	Case Date	Case Time	Case Status	Case Notes
1	John Doe	123 Main St	New York	NY	10001	212-555-1234	john.doe@example.com	2023-10-27	14:30	Completed	Initial assessment and data collection.
2	Jane Smith	456 Elm St	Los Angeles	CA	90001	310-555-5678	jane.smith@example.com	2023-10-28	10:00	In Progress	Interview with subject and review of records.
3	Robert Johnson	789 Oak St	Chicago	IL	60601	312-555-9012	robert.johnson@example.com	2023-10-29	09:00	Pending	Awaiting further information from the subject.
4	Emily White	101 Pine St	San Francisco	CA	94101	415-555-3456	emily.white@example.com	2023-10-30	11:00	Completed	Final report and recommendations.
5	Michael Brown	202 Cedar St	Phoenix	AZ	85001	602-555-7890	michael.brown@example.com	2023-10-31	13:00	In Progress	Review of case file and follow-up actions.
6	Sarah Green	303 Birch St	Philadelphia	PA	19101	215-555-2345	sarah.green@example.com	2023-11-01	15:00	Pending	Waiting for external agency response.
7	David Lee	404 Maple St	San Diego	CA	92101	619-555-6789	david.lee@example.com	2023-11-02	10:30	Completed	Case closed, all requirements met.
8	Lisa King	505 Walnut St	Portland	OR	97201	503-555-0123	lisa.king@example.com	2023-11-03	12:00	In Progress	Conducting follow-up interviews.
9	James Hall	606 Elm St	Seattle	WA	98101	206-555-4567	james.hall@example.com	2023-11-04	08:00	Pending	Reviewing case file for closure.
10	Amanda Taylor	707 Oak St	Denver	CO	80201	303-555-8901	amanda.taylor@example.com	2023-11-05	16:00	Completed	Final review and sign-off.

- 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 Comments	Case Actions
1	John Doe	Medical	Open	2023-01-01	New York	John Doe, 45, male, reported chest pain and shortness of breath.	Initial assessment: vital signs stable, no obvious trauma.	Referral to cardiologist for further evaluation.	Follow up in 2 weeks.
2	Jane Smith	Medical	Closed	2023-01-05	California	Jane Smith, 32, female, reported severe headache and nausea.	Initial assessment: vital signs stable, no obvious trauma.	Referral to neurologist for further evaluation.	Follow up in 2 weeks.
3	Michael Brown	Medical	Open	2023-01-10	Texas	Michael Brown, 58, male, reported persistent cough and wheezing.	Initial assessment: vital signs stable, no obvious trauma.	Referral to pulmonologist for further evaluation.	Follow up in 2 weeks.
4	Sarah Johnson	Medical	Closed	2023-01-15	Florida	Sarah Johnson, 28, female, reported severe abdominal pain and vomiting.	Initial assessment: vital signs stable, no obvious trauma.	Referral to gastroenterologist for further evaluation.	Follow up in 2 weeks.
5	David Wilson	Medical	Open	2023-01-20	Illinois	David Wilson, 65, male, reported persistent back pain and numbness.	Initial assessment: vital signs stable, no obvious trauma.	Referral to orthopedist for further evaluation.	Follow up in 2 weeks.
6	Emily Davis	Medical	Closed	2023-01-25	Ohio	Emily Davis, 35, female, reported severe anxiety and panic attacks.	Initial assessment: vital signs stable, no obvious trauma.	Referral to psychiatrist for further evaluation.	Follow up in 2 weeks.
7	Robert Miller	Medical	Open	2023-02-01	Georgia	Robert Miller, 72, male, reported persistent fatigue and weakness.	Initial assessment: vital signs stable, no obvious trauma.	Referral to endocrinologist for further evaluation.	Follow up in 2 weeks.
8	Lisa Anderson	Medical	Closed	2023-02-05	Arizona	Lisa Anderson, 40, female, reported severe joint pain and swelling.	Initial assessment: vital signs stable, no obvious trauma.	Referral to rheumatologist for further evaluation.	Follow up in 2 weeks.
9	Christopher Lee	Medical	Open	2023-02-10	Colorado	Christopher Lee, 50, male, reported persistent skin rash and itching.	Initial assessment: vital signs stable, no obvious trauma.	Referral to dermatologist for further evaluation.	Follow up in 2 weeks.
10	Amanda White	Medical	Closed	2023-02-15	Connecticut	Amanda White, 30, female, reported severe menstrual pain and irregular cycles.	Initial assessment: vital signs stable, no obvious trauma.	Referral to gynecologist for further evaluation.	Follow up in 2 weeks.
11	Matthew Black	Medical	Open	2023-02-20	Delaware	Matthew Black, 60, male, reported persistent vision changes and blurriness.	Initial assessment: vital signs stable, no obvious trauma.	Referral to ophthalmologist for further evaluation.	Follow up in 2 weeks.
12	Olivia Green	Medical	Closed	2023-02-25	District of Columbia	Olivia Green, 25, female, reported severe allergic reactions and hives.	Initial assessment: vital signs stable, no obvious trauma.	Referral to allergist for further evaluation.	Follow up in 2 weeks.
13	Benjamin Hall	Medical	Open	2023-03-01	Hawaii	Benjamin Hall, 70, male, reported persistent urinary issues and frequent urination.	Initial assessment: vital signs stable, no obvious trauma.	Referral to urologist for further evaluation.	Follow up in 2 weeks.
14	Sophia King	Medical	Closed	2023-03-05	Idaho	Sophia King, 38, female, reported severe hair loss and thinning.	Initial assessment: vital signs stable, no obvious trauma.	Referral to dermatologist for further evaluation.	Follow up in 2 weeks.
15	Lucas Young	Medical	Open	2023-03-10	Indiana	Lucas Young, 55, male, reported persistent digestive issues and bloating.	Initial assessment: vital signs stable, no obvious trauma.	Referral to gastroenterologist for further evaluation.	Follow up in 2 weeks.
16	Isabella Lopez	Medical	Closed	2023-03-15	Iowa	Isabella Lopez, 22, female, reported severe acne and skin irritation.	Initial assessment: vital signs stable, no obvious trauma.	Referral to dermatologist for further evaluation.	Follow up in 2 weeks.
17	Ethan Scott	Medical	Open	2023-03-20	Kansas	Ethan Scott, 68, male, reported persistent hearing loss and tinnitus.	Initial assessment: vital signs stable, no obvious trauma.	Referral to audiologist for further evaluation.	Follow up in 2 weeks.
18	Aria Taylor	Medical	Closed	2023-03-25	Kentucky	Aria Taylor, 33, female, reported severe menstrual cramps and pain.	Initial assessment: vital signs stable, no obvious trauma.	Referral to gynecologist for further evaluation.	Follow up in 2 weeks.
19	Leo Walker	Medical	Open	2023-04-01	Louisiana	Leo Walker, 52, male, reported persistent joint pain and stiffness.	Initial assessment: vital signs stable, no obvious trauma.	Referral to rheumatologist for further evaluation.	Follow up in 2 weeks.
20	Mia Harris	Medical	Closed	2023-04-05	Maine	Mia Harris, 27, female, reported severe anxiety and panic attacks.	Initial assessment: vital signs stable, no obvious trauma.	Referral to psychiatrist for further evaluation.	Follow up in 2 weeks.
21	Noah Clark	Medical	Open	2023-04-10	Maryland	Noah Clark, 63, male, reported persistent skin rash and itching.	Initial assessment: vital signs stable, no obvious trauma.	Referral to dermatologist for further evaluation.	Follow up in 2 weeks.
22	Charlotte Evans	Medical	Closed	2023-04-15	Massachusetts	Charlotte Evans, 31, female, reported severe menstrual pain and irregular cycles.	Initial assessment: vital signs stable, no obvious trauma.	Referral to gynecologist for further evaluation.	Follow up in 2 weeks.
23	Oliver Reed	Medical	Open	2023-04-20	Michigan	Oliver Reed, 57, male, reported persistent vision changes and blurriness.	Initial assessment: vital signs stable, no obvious trauma.	Referral to ophthalmologist for further evaluation.	Follow up in 2 weeks.
24	Amelia Baker	Medical	Closed	2023-04-25	Minnesota	Amelia Baker, 29, female, reported severe allergic reactions and hives.	Initial assessment: vital signs stable, no obvious trauma.	Referral to allergist for further evaluation.	Follow up in 2 weeks.
25	William Nelson	Medical	Open	2023-05-01	Mississippi	William Nelson, 71, male, reported persistent urinary issues and frequent urination.	Initial assessment: vital signs stable, no obvious trauma.	Referral to urologist for further evaluation.	Follow up in 2 weeks.
26	Harper Hill	Medical	Closed	2023-05-05	Missouri	Harper Hill, 36, female, reported severe hair loss and thinning.	Initial assessment: vital signs stable, no obvious trauma.	Referral to dermatologist for further evaluation.	Follow up in 2 weeks.
27	James Adams	Medical	Open	2023-05-10	Montana	James Adams, 59, male, reported persistent digestive issues and bloating.	Initial assessment: vital signs stable, no obvious trauma.	Referral to gastroenterologist for further evaluation.	Follow up in 2 weeks.
28	Evelyn King	Medical	Closed	2023-05-15	Nebraska	Evelyn King, 24, female, reported severe acne and skin irritation.	Initial assessment: vital signs stable, no obvious trauma.	Referral to dermatologist for further evaluation.	Follow up in 2 weeks.
29	Samuel Wright	Medical	Open	2023-05-20	Nevada	Samuel Wright, 66, male, reported persistent hearing loss and tinnitus.	Initial assessment: vital signs stable, no obvious trauma.	Referral to audiologist for further evaluation.	Follow up in 2 weeks.
30	Abigail Green	Medical	Closed	2023-05-25	New Hampshire	Abigail Green, 34, female, reported severe menstrual cramps and pain.	Initial assessment: vital signs stable, no obvious trauma.	Referral to gynecologist for further evaluation.	Follow up in 2 weeks.
31	Benjamin Hall	Medical	Open	2023-06-01	New Jersey	Benjamin Hall, 53, male, reported persistent joint pain and stiffness.	Initial assessment: vital signs stable, no obvious trauma.	Referral to rheumatologist for further evaluation.	Follow up in 2 weeks.
32	Madeline King	Medical	Closed	2023-06-05	New Mexico	Madeline King, 26, female, reported severe anxiety and panic attacks.	Initial assessment: vital signs stable, no obvious trauma.	Referral to psychiatrist for further evaluation.	Follow up in 2 weeks.
33	Lucas Young	Medical	Open	2023-06-10	New York	Lucas Young, 61, male, reported persistent skin rash and itching.	Initial assessment: vital signs stable, no obvious trauma.	Referral to dermatologist for further evaluation.	Follow up in 2 weeks.
34	Isabella Lopez	Medical	Closed	2023-06-15	North Carolina	Isabella Lopez, 30, female, reported severe menstrual pain and irregular cycles.	Initial assessment: vital signs stable, no obvious trauma.	Referral to gynecologist for further evaluation.	Follow up in 2 weeks.
35	Ethan Scott	Medical	Open	2023-06-20	North Dakota	Ethan Scott, 64, male, reported persistent vision changes and blurriness.	Initial assessment: vital signs stable, no obvious trauma.	Referral to ophthalmologist for further evaluation.	Follow up in 2 weeks.
36	Aria Taylor	Medical	Closed	2023-06-25	Ohio	Aria Taylor,			

- 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]