2024 IUT 1st Admission Test(SBL)

Math Examination(TYPE A)

< Multiple choice Types > There is only one correct answer for each question. Mark your choice on the OMR answer sheet. The points for each question are listed next to the question number.

1. [3 points]

Compute $\dfrac{3}{\sqrt{11-\sqrt{112}}}$.

① $\sqrt{7}$ ② $1+\sqrt{7}$ ③ $2+\sqrt{7}$
④ $3+\sqrt{7}$ ⑤ $4+\sqrt{7}$

2. [3 points]

When $\alpha^2-\dfrac{1}{\alpha^2}=2$ for a real number α, find $\alpha^2+\dfrac{1}{\alpha^2}$.

① $\dfrac{\sqrt{2}}{4}$ ② $\dfrac{\sqrt{2}}{2}$ ③ $\sqrt{2}$ ④ $2\sqrt{2}$ ⑤ $4\sqrt{2}$

3. [3 points]

Compute $\displaystyle\sum_{n=1}^{8}\frac{1}{n^2+2n}$.

① $\dfrac{17}{45}$ ② $\dfrac{19}{45}$ ③ $\dfrac{23}{45}$ ④ $\dfrac{26}{45}$ ⑤ $\dfrac{29}{45}$

4. [3 points]

When α, β, γ are the solutions of $x^3+6x^2+8x-2=0$, find $\dfrac{\gamma}{\alpha\beta}+\dfrac{\alpha}{\beta\gamma}+\dfrac{\beta}{\gamma\alpha}$.

① 2 ② 4 ③ 6 ④ 8 ⑤ 10

5. [3 points]

Compute $\log_3 4\times\log_{\sqrt{5}}3\times\log_{\sqrt{2}}25$.

① 12 ② 14 ③ 16 ④ 18 ⑤ 20

6. [3 points]

When α, β satisfy $2^{\alpha}\cdot 2^{\beta}=8$ and $\log_2\alpha+\log_2\beta=-2$, find $\alpha^2+\beta^2$.

① $\dfrac{11}{2}$ ② $\dfrac{13}{2}$ ③ $\dfrac{15}{2}$ ④ $\dfrac{17}{2}$ ⑤ $\dfrac{19}{2}$

7. [3 points]

When $A=\begin{pmatrix}2&-1\\3&5\end{pmatrix}$, $B=\begin{pmatrix}3&1\\2&1\end{pmatrix}$ and $AB^{-1}A=\begin{pmatrix}a&b\\c&d\end{pmatrix}$, find $a+b+c+d$.

① 51 ② 53 ③ 55 ④ 57 ⑤ 59

8. [3 points]

When $A=\begin{pmatrix}1&0\\3&-1\end{pmatrix}$, $B=\begin{pmatrix}2&-3\\-1&1\end{pmatrix}$ and $A(A+B)A^{-1}=\begin{pmatrix}a&b\\c&d\end{pmatrix}$, find $a+b+c+d$.

① -10 ② -12 ③ -14 ④ -16 ⑤ -18

9. [3 points]

When α, β are the solutions of $16^x-16\cdot 4^x+48=0$, find $\alpha+\beta$.

① $2+\log_4 3$ ② $3+\log_4 3$ ③ $6+\log_4 3$
④ $8+\log_4 3$ ⑤ $9+\log_4 3$

10. [3 points]
When $f(x) = 4^x + 4^{-x} - 5(2^x + 2^{-x}) + 8$ attains the minimum value b at $x = a$ with $a \geq 0$, find $a + b$.

① $\frac{3}{2}$ ② $\frac{3}{4}$ ③ $\frac{1}{2}$ ④ $\frac{3}{8}$ ⑤ $\frac{3}{10}$

11. [3 points]
When α, β are the solutions of $\log_2 x + 8\log_x 2 = 6$, find $\alpha + \beta$.

① 4 ② 8 ③ 12 ④ 16 ⑤ 20

12. [3 points]
Find the minimum value of $f(x) = 3 \mid x + 2 \mid + 4 \mid x - 1 \mid$.

① 1 ② 3 ③ 5 ④ 7 ⑤ 9

13. [3 points]
Compute $\left(\frac{\sqrt{2} - \sqrt{2}\,i}{\sqrt{3} + i}\right)^{12}$.

① -1 ② 1 ③ i ④ $1 - i$ ⑤ $1 + i$

14. [3 points]
When $x = \frac{\sqrt{3} - i}{\sqrt{3} + i}$ and $y = \frac{\sqrt{3} + i}{\sqrt{3} - i}$, find $\frac{y+1}{x} - \frac{x+1}{y}$.

① $2\sqrt{3}\,i$ ② $4\sqrt{3}\,i$ ③ $6\sqrt{3}\,i$
④ $8\sqrt{3}\,i$ ⑤ $10\sqrt{3}\,i$

15. [3 points]
When $\sin x - \cos x = \frac{1}{\sqrt{2}}$, find $\sin^3 x - \cos^3 x$.

① $\frac{\sqrt{2}}{8}$ ② $\frac{3\sqrt{2}}{8}$ ③ $\frac{5\sqrt{2}}{8}$
④ $\frac{7\sqrt{2}}{8}$ ⑤ $\frac{9\sqrt{2}}{8}$

16. [3 points]
Find the sum of all solutions of $\cos^2 \frac{x}{2} + \sin^2 x = \frac{3}{2}$ for $0 \leq x \leq \pi$.

① $\frac{\pi}{2}$ ② $\frac{2\pi}{3}$ ③ $\frac{3\pi}{4}$ ④ $\frac{5\pi}{6}$ ⑤ π

17. [3 points]
Find the sum of all solutions of $\cos 2x = 2 + 3\sin x$ for $0 \leq x \leq 2\pi$.

① $\frac{5\pi}{2}$ ② 3π ③ $\frac{7\pi}{2}$ ④ 4π ⑤ $\frac{9\pi}{2}$

18. [3 points]
Find the number of pairs (x, y) satisfying $\frac{1}{x} + \frac{1}{y} = \frac{1}{3}$, where x, y are positive integers.

① 1 ② 3 ③ 5 ④ 7 ⑤ 9

19. [3 points]
Compute $\lim_{x \to \infty} \frac{\sqrt{4x^2 + 1} - 2x}{\sqrt{x^2 + 1} - x}$.

① $\frac{1}{2}$ ② $\frac{1}{3}$ ③ $\frac{1}{4}$ ④ $\frac{1}{6}$ ⑤ $\frac{1}{8}$

20. [3 points]
When $y = ax + b$ is the tangent line to $f(x) = x^5 - 2x^3 - 3x - 1$ at $x = 1$, find $a^2 + b^2$.

① 11 ② 13 ③ 15 ④ 17 ⑤ 19

21. [4 points]

When $\lim_{x\to 1}\frac{f(x)}{x-1}=9$ for a continuous function $f(x)$, find $\lim_{x\to 1}\frac{\sqrt{x}-1+f(x)}{x^3-1}$.

① $\frac{11}{6}$ ② $\frac{13}{6}$ ③ $\frac{5}{2}$ ④ $\frac{17}{6}$ ⑤ $\frac{19}{6}$

22. [4 points]

When $x^3+6x^2+9x+k=0$, $k\neq 0$ has exactly two distinct real solutions α and β, find $\alpha+\beta$.

① -1 ② -3 ③ -5 ④ -7 ⑤ -9

23. [4 points]

When M and m are the maximum and minimum values of $f(x)=x^4-2x^3+x^2+1$ for $0\le x\le 1$, find $M+m$.

① $\frac{31}{16}$ ② $\frac{33}{16}$ ③ $\frac{35}{16}$ ④ $\frac{37}{16}$ ⑤ $\frac{39}{16}$

24. [4 points]

Find the farthest distance from $(1,0)$ to a point on $4x^2+y^2=4$.

① $\frac{2}{\sqrt{3}}$ ② $\frac{4}{\sqrt{3}}$ ③ $\frac{6}{\sqrt{3}}$ ④ $\frac{8}{\sqrt{3}}$ ⑤ $\frac{10}{\sqrt{3}}$

25. [4 points]

When $f(2)=3$, $f'(2)=7$ and $g(x)=\frac{\sqrt{f(x)+1}}{3x+2}$, find $g'(2)$.

① $\frac{1}{2}$ ② $\frac{1}{4}$ ③ $\frac{1}{8}$ ④ $\frac{1}{12}$ ⑤ $\frac{1}{16}$

26. [4 points]

Compute $\int_0^1 x(2x^2+1)^3\,dx$.

① 5 ② 7 ③ 9 ④ 12 ⑤ 14

27. [4 points]

When $f(x)=\frac{ax^2+2x+b}{x^2+1}$ has a local maximum $f(1)=5$ at $x=1$, find a^2+b^2.

① 20 ② 24 ③ 28 ④ 32 ⑤ 36

28. [4 points]

Find the area of the region enclosed by $y=x^3+3x^2-2x-3$ and $y=x^3+2x^2+2x-6$.

① $\frac{2}{3}$ ② $\frac{4}{3}$ ③ 2 ④ $\frac{8}{3}$ ⑤ $\frac{10}{3}$

29. [4 points]

Compute $\int_0^2 |x^2-1|\,dx$.

① 2 ② 4 ③ 6 ④ 8 ⑤ 10

30. [4 points]

When a differentiable function $f(x)$ satisfies $\int_0^x tf(t)\,dt=\sqrt{3x^2+1}-1$ for $x>0$, find $f'(1)$.

① $-\frac{1}{8}$ ② $-\frac{3}{8}$ ③ $-\frac{5}{8}$ ④ $-\frac{7}{8}$ ⑤ $-\frac{9}{8}$

2024 IUT 1ST SBL Answer Sheets

[TypeA]

No.	1	2	3	4	5	6	7	8	9	10
Ans.	③	④	⑤	⑤	③	④	②	③	①	②
No.	11	12	13	14	15	16	17	18	19	20
Ans.	⑤	⑤	①	①	③	④	⑤	②	①	④
No.	21	22	23	24	25	26	27	28	29	30
Ans.	⑤	③	②	②	③	①	④	②	①	⑤

2024 IUT Admission Test(SOCIE, Type A)

Math & Physics Examination

<Multiple choice Types> There is only one correct answer per each question. Mark your answer choice on the OMR answer sheet.

○ For each correct answer, you will get the points indicated next to each question number.

○ No penalty point is applied to an incorrect answer.

1. [2 points]
Simplify $2^{\log_2 3 \times \log_9 8}$.

① $\sqrt{2}$ ② 2 ③ $2\sqrt{2}$ ④ 4 ⑤ $4\sqrt{2}$

2. [2 points]
When α, β, γ are solutions of
$$x^3 - 4x^2 + 3x + 1 = 0,$$
find $\frac{\alpha\beta}{\gamma} + \frac{\beta\gamma}{\alpha} + \frac{\gamma\alpha}{\beta}$.

① -17 ② -15 ③ -13
④ -11 ⑤ -9

3. [2 points]
Find $\lim_{x \to 0} \frac{e^x - e^{-x}}{\sin x}$.

① 0 ② 2 ③ 4 ④ 6 ⑤ 8

4. [2 points]
When $\frac{\sin\theta}{1+\cos\theta} = 2$, find $tg\,\theta$.

① $-\frac{4}{3}$ ② $-\frac{2}{3}$ ③ 0 ④ $\frac{2}{3}$ ⑤ $\frac{4}{3}$

5. [2 points]
Find $\lim_{n \to \infty} \left(\sqrt{n^2+4n} - \sqrt{n^2-4n}\right)$.

① 1 ② 2 ③ 3 ④ 4 ⑤ 5

6. [2 points]
Find $\sum_{n=1}^{\infty} \frac{1}{2^n} \sin\frac{n\pi}{2}$.

① $\frac{1}{5}$ ② $\frac{2}{5}$ ③ $\frac{3}{5}$ ④ $\frac{4}{5}$ ⑤ 1

7. [3 points]
When $f(x) = \frac{e^{3x}}{2+\sin x}$, find $f'(0)$.

① $\frac{1}{4}$ ② $\frac{1}{2}$ ③ $\frac{3}{4}$ ④ 1 ⑤ $\frac{5}{4}$

8. [3 points]

When $\begin{pmatrix} 2 & 1 \\ -3 & -1 \end{pmatrix}^{10} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$, find $a+b+c+d$.

① -3 ② -1 ③ 0 ④ 1 ⑤ 3

9. [3 points]

Find the sum of all solutions of

$$\cos 2x + 3\sin x + 1 = 0$$

for $0 \le x \le 2\pi$.

① π ② $\frac{3\pi}{2}$ ③ 2π ④ $\frac{5\pi}{2}$ ⑤ 3π

10. [3 points]

When $a_1 = 2$ and $a_{n+1} = 3a_n - 2$ for $n = 1, 2, 3, \cdots$, find a_{100}.

① $3^{99} - 2$ ② $3^{99} - 1$ ③ 3^{99}
④ $3^{99} + 1$ ⑤ $3^{99} + 2$

11. [3 points]

Find $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^2+n}\,(\sqrt{n}+\sqrt{n+1})}$.

① $\frac{1}{2}$ ② 1 ③ $\frac{3}{2}$ ④ 2 ⑤ $\frac{5}{2}$

12. [3 points]

Compute $\int_0^{\pi} \sin x \cos 2x \, dx$.

① $-\frac{2}{3}$ ② $-\frac{1}{3}$ ③ 0
④ $\frac{1}{3}$ ⑤ $\frac{2}{3}$

13. [4 points]

Find the minimum value of

$$f(x) = \log_2 x + \log_x 4$$

for $x > 1$.

① $\frac{\sqrt{2}}{2}$ ② 1 ③ $\sqrt{2}$ ④ 2 ⑤ $2\sqrt{2}$

14. [4 points]

Compute $\lim_{n\to\infty} \sum_{k=1}^{n} \frac{1}{n} \ln\left(1 + \frac{2k}{n}\right)$.

① $\frac{\ln 3 - 2}{8}$ ② $\frac{\ln 3 - 2}{4}$ ③ $\frac{3\ln 3 - 2}{8}$
④ $\frac{3\ln 3 - 2}{2}$ ⑤ $\frac{5\ln 3 - 2}{8}$

15. [4 points]

When M, m are the maximum and minimum values of $f(x) = \frac{x}{x^2+x+1}$, respectively, find $M+m$.

① $-\frac{2}{3}$ ② $-\frac{1}{3}$ ③ 0 ④ $\frac{1}{3}$ ⑤ $\frac{2}{3}$

16. [4 points]
When the angle between two lines
$x+2y+1=0,\ ax+y-2=0$
is $\frac{\pi}{4}$, find the constant a, where $a>0$.

① 1 ② 2 ③ 3 ④ 4 ⑤ 5

17. [4 points]
Compute $\lim_{h\to 0}\frac{1}{h}\int_{2-h}^{2+h} e^{-x^2}dx$.

① $-e^{-4}$ ② $-e^{-4}$ ③ 0
④ e^{-4} ⑤ $2e^{-4}$

18. [5 points]
When $f(x)=\begin{cases} ae^x+2\cos x, & x\le 0 \\ b\sin x+1, & x>0 \end{cases}$ is
differentiable at $x=0$ for constants a, b, find a^2+b^2.

① 2 ② 4 ③ 6 ④ 8 ⑤ 10

19. [5 points]
Find the area of the region enclosed by
$y=2x^2-5x+3,\ y=-x^2+7x-6$.

① 3 ② $\frac{7}{2}$ ③ 4 ④ $\frac{9}{2}$ ⑤ 5

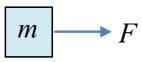
20. [5 points]
When the line $y=2x+1$ meets the curve $y=ke^x$ at only one point, find the constant k.

① $\frac{1}{\sqrt{e}}$ ② $\frac{2}{\sqrt{e}}$ ③ $\frac{3}{\sqrt{e}}$
④ $\frac{4}{\sqrt{e}}$ ⑤ $\frac{5}{\sqrt{e}}$

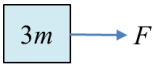
21. [5 points]
When $a_n=\int_0^1 (1-x^2)^n dx$, find $\frac{a_{101}}{a_{100}}$.

① $\frac{200}{201}$ ② $\frac{201}{202}$ ③ $\frac{202}{203}$
④ $\frac{203}{204}$ ⑤ $\frac{204}{205}$

22. [3 points]
When a force acts on a block as shown below, which one has the greatest acceleration? (In the picture, m represents mass and F represents force.)

① 

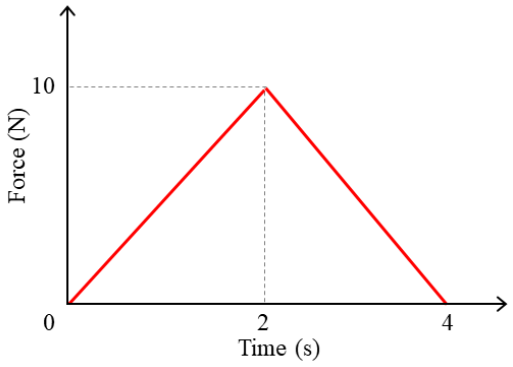
② 

③ 

④ 

⑤ 

23. [4 points]
A force whose magnitude changes with time is applied for 4 seconds to an object with a mass of 5 kg at rest on a frictionless horizontal surface, as shown in the figure below. What is the speed of the object after 4 seconds?

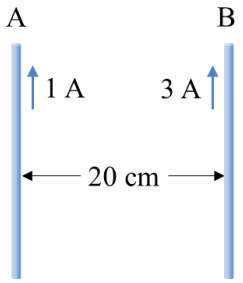


① 1 m/s ② 2 m/s ③ 4 m/s
④ 5 m/s ⑤ 8 m/s

24. [3 points]
When a particle with a mass of 1.0 g and a charge of 1.0×10^{-5} C that is at rest at point A accelerates to point B, where the potential is 2 V lower than that of point A, what is the speed of the particle at the moment it reaches point B?

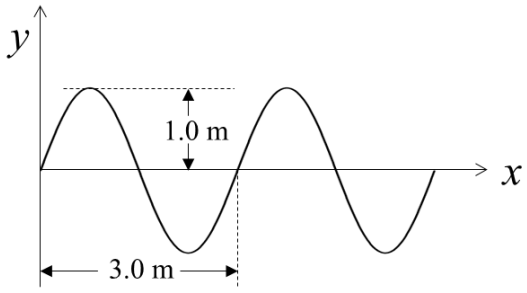
① 0.1 m/s ② 0.2 m/s ③ 0.4 m/s
④ 0.5 m/s ⑤ 1.0 m/s

25. [3 points]
As shown in the figure below, two infinitely long straight wires A and B, carrying currents of 1 A and 3 A respectively, flowing in the same direction, are 20 cm apart. How far from wire A is the point where the magnetic field strength is 0 between two straight wires?



① 2 cm ② 3 cm ③ 4 cm
④ 5 cm ⑤ 10 cm

26. [3 points]
The picture below shows the shape of a wave traveling in the x-axis direction at a certain moment. What is the propagation speed of this wave when its period is 2.0 seconds?



① 0.5 m/s ② 1.0 m/s ③ 1.5 m/s
④ 2.0 m/s ⑤ 3.0 m/s

27. [3 points]

When Young's double slit experiment is performed using light with a wavelength of $4.0 \times 10^{-7}\,\mathrm{m}$, the gap between the interference patterns is $2.0\,\mathrm{mm}$. If the same experiment is performed with different light and the interference pattern is $3.0\,\mathrm{mm}$ apart, what is the wavelength of this light?

① $1.5 \times 10^{-7}\,\mathrm{m}$ ② $3.0 \times 10^{-7}\,\mathrm{m}$

③ $4.0 \times 10^{-7}\,\mathrm{m}$ ④ $5.0 \times 10^{-7}\,\mathrm{m}$

⑤ $6.0 \times 10^{-7}\,\mathrm{m}$

28. [3 points]

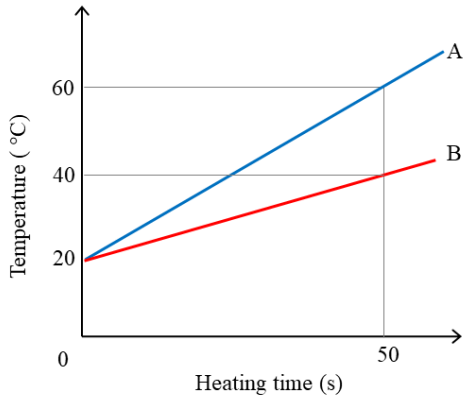
When light with a photon energy of $2W$ was shined on a metal plate with a work function of W, the maximum speed of the photoelectrons emitted was v. What is the maximum speed of photoelectrons emitted when light with a photon energy of $5W$ is shined on the same metal plate?

① $2v$ ② $\sqrt{2}v$ ③ $3v$

④ $\sqrt{3}v$ ⑤ $4v$

29. [3 points]

Two objects A and B, each with a mass of $100\,\mathrm{g}$, are heated equally with a heater of the same power and the temperature is measured at regular time intervals to obtain results as shown in the graph below. What is the ratio c_A/c_B of the specific heats of the two objects? (However, ignore heat loss that may occur when heating the objects.)

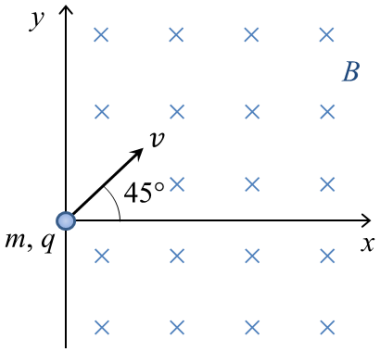


① 2 ② $\frac{1}{2}$ ③ $\frac{2}{3}$

④ $\frac{3}{2}$ ⑤ $\frac{1}{3}$

30. [5 points]

A uniform magnetic field B oriented perpendicular to the xy-plane exists in the region where $x \geq 0$. The direction of the magnetic field is into the page as shown in the figure below. A particle with mass m and charge $q\,(q > 0)$ is incident at a speed v at an angle of 45° to the x-axis from the origin. If the coordinates of the point where the particle intersects the y-axis are $(0, y_1)$, what is the value of y_1?



① $\frac{mv}{Bq}$ ② $\frac{mv}{2Bq}$ ③ $\frac{mv}{\sqrt{2}Bq}$

④ $\frac{\sqrt{2}mv}{Bq}$ ⑤ $\frac{2mv}{Bq}$

2024 IUT Admission Test(SOCIE) MATH / Physics

1	2	3	4	5	6	7
③	①	②	①	④	②	⑤
8	9	10	11	12	13	14
④	⑤	④	②	①	⑤	④
15	16	17	18	19	20	21
①	③	⑤	①	③	②	③
22	23	24	25	26	27	28
⑤	③	②	④	③	⑤	①
29	30					
②	④					