

2022 IUT Admission Test(SBL, Type A)

Math 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. [4 points]

When $a = \frac{\sqrt{3+\sqrt{5}}}{\sqrt{3-\sqrt{5}}}$ and $b = \frac{\sqrt{3-\sqrt{5}}}{\sqrt{3+\sqrt{5}}}$,

find $a+b$.

- ① 1 ② 3 ③ 5 ④ 7 ⑤ 9

2. [4 points]

When $a + \frac{1}{a} = 3$, find $a^3 + \frac{1}{a^3}$.

- ① 12 ② 14 ③ 16 ④ 18 ⑤ 20

3. [4 points]

Compute $\log_3 4 \times \log_2 7 \times \log_7 9$.

- ① 2 ② 4 ③ 6 ④ 8 ⑤ 10

4. [4 points]

When $4x^3 + ax^2 + bx + c$ is divided by $x^2 - 1$, the remainder is 0. When $4x^3 + ax^2 + bx + c$ is divided by $x - 2$, the remainder is 24. Find $a^2 + b^2 + c^2$.

- ① 12 ② 14 ③ 16 ④ 18 ⑤ 20

5. [4 points]

When $x > 0$, $y > 0$ and $xy = 6$, find the minimum value of $\frac{1}{x^2} + \frac{1}{y^2}$.

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

6. [4 points]

When $17^x = 16$ and $68^y = 8$, find $\frac{4}{x} - \frac{3}{y}$.

- ① -2 ② -1 ③ 0 ④ 1 ⑤ 2

7. [5 points]

Compute $\sum_{n=1}^{10} \frac{1}{n(n+2)}$.

- ① $\frac{175}{264}$ ② $\frac{185}{264}$ ③ $\frac{195}{264}$ ④ $\frac{205}{264}$ ⑤ $\frac{215}{264}$

8. [5 points]

When $A = \begin{pmatrix} 3 & 2 \\ 1 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 3 & 2 \\ 8 & 5 \end{pmatrix}$ and $A^{-1}B^{-1} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$, find $a+b+c+d$.

- ① 1 ② 3 ③ 5 ④ 7 ⑤ 9

9. [5 points]

When α , β and γ are the solutions of $x^3 + 2x - 10 = 0$, find $\frac{1}{\alpha^2} + \frac{1}{\beta^2} + \frac{1}{\gamma^2}$.

- ① $\frac{1}{10}$ ② $\frac{1}{15}$ ③ $\frac{1}{20}$ ④ $\frac{1}{25}$ ⑤ $\frac{1}{30}$

10. [5 points]

Compute $\left(\frac{1+\sqrt{3}i}{2}\right)^{2022}$.

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

11. [5 points]

Compute $\cos\frac{7\pi}{12}$.

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

12. [5 points]

When $\sin 2\theta = \frac{3}{5}$ and $0 < \theta < \frac{\pi}{4}$, find $\sin\theta$.

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

13. [5 points]

When α and β are the solutions of $\cos 2x + 3\sin x + 1 = 0$, ($0 \leq x \leq 2\pi$), find $\alpha + \beta$.

- ① π ② 2π ③ 3π ④ 4π ⑤ 5π

14. [5 points]

Find the sum of all solutions of

$$4^x - 2^{x+1} + 2^{-x+1} = 1.$$

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

15. [6 points]

Find $\lim_{x \rightarrow 0} \frac{2x^3}{(1 - \cos x) \sin 3x}$.

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

16. [6 points]

Find the minimum value of

$$f(x) = \frac{1}{4}x^4 + 2x^2 - 5x + 3.$$

- ① $\frac{1}{4}$ ② $\frac{5}{4}$ ③ $\frac{9}{4}$ ④ $\frac{13}{4}$ ⑤ $\frac{17}{4}$

17. [6 points]

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

- ① 2 ② 4 ③ 6 ④ 8 ⑤ 10

18. [6 points]

When $f(x) = \frac{2}{\sqrt{x+1}}$, find $f'(4)$.

- ① $-\frac{1}{10}$ ② $-\frac{1}{12}$ ③ $-\frac{1}{14}$
④ $-\frac{1}{16}$ ⑤ $-\frac{1}{18}$

19. [6 points]

Find $\int_0^1 (2x+1)^{10} dx$.

- ① $\frac{1}{22}(3^{11}-1)$ ② $\frac{1}{33}(3^{11}-1)$ ③ $\frac{1}{44}(3^{11}-1)$
④ $\frac{1}{55}(3^{11}-1)$ ⑤ $\frac{1}{66}(3^{11}-1)$

20. [6 points]

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

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

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2022 IUT Admission Test (SBL) Answers

Type A

1	2	3	4	5	6	7	8	9	10
②	④	②	③	②	①	①	③	④	③
11	12	13	14	15	16	17	18	19	20
⑤	⑤	③	④	④	①	①	⑤	①	⑤

2022 IUT Admission Test(SOCIE, Type A)

Math 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.
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1. [4 points]

When $a = \sqrt{2} + \sqrt{3}$ and $b = \sqrt{2} - \sqrt{3}$, find $a^3 - b^3$.

- ① $12\sqrt{3}$ ② $15\sqrt{3}$ ③ $18\sqrt{3}$
 ④ $21\sqrt{3}$ ⑤ $24\sqrt{3}$

2. [4 points]

When $\frac{3^t + 3^{-t}}{3^t - 3^{-t}} = \sqrt{5}$, find $A = 9^t + 9^{-t}$.

- ① 1 ② 3 ③ 5 ④ 7 ⑤ 9

3. [4 points]

When $2^a = 4^b$ and $\frac{a}{b} = \log_3 c$, find c .

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

4. [4 points]

When $A = \begin{pmatrix} 2 & 1 \\ 3 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ and

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

- ① -2 ② -1 ③ 0 ④ 1 ⑤ 2

5. [5 points]

Compute $\left(\frac{1 + \sqrt{3}i}{1 + i}\right)^{12}$.

- ① $64i$ ② $-64i$ ③ 64 ④ -64 ⑤ $64\sqrt{3}$

6. [5 points]

When α and β are the solutions of

$\frac{2}{\log_2 x + 3} = \log_4 x$, find $\alpha\beta$.

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

7. [5 points]

When $\cos\alpha + \cos\beta = \frac{4}{3}$ and $\sin\alpha + \sin\beta = \frac{2}{3}$, find $\cos(\alpha - \beta)$.

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

8. [5 points]

Compute $\lim_{x \rightarrow 0} \frac{(1 - \cos 2x) \operatorname{tg}(x^2)}{4x^4}$, where

$\operatorname{tg}(x) = \frac{\sin x}{\cos x}$.

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

9. [5 points]

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

- ① 21 ② 23 ③ 25 ④ 27 ⑤ 29

10. [5 points]

When $f(x) = \frac{\sqrt[3]{x} - 1}{\sqrt[3]{x} + 1}$, find $f'(8)$.

- ① $\frac{1}{38}$ ② $\frac{1}{42}$ ③ $\frac{1}{46}$ ④ $\frac{1}{50}$ ⑤ $\frac{1}{54}$

11. [6 points]

Compute $\int_0^{\frac{\pi}{2}} \sin(2x)\cos(\cos x) dx$.

- ① $2\sin 1$ ② $2\cos 1$ ③ $2(\sin 1 - 1)$
④ $2(\cos 1 - 1)$ ⑤ $2(\sin 1 + \cos 1 - 1)$

12. [6 points]

Compute $\int_0^1 x(1-x)^{100} dx$.

- ① $\frac{1}{99 \times 100}$ ② $\frac{1}{100 \times 101}$ ③ $\frac{1}{101 \times 102}$
④ $\frac{1}{102 \times 103}$ ⑤ $\frac{1}{103 \times 104}$

13. [6 points]

Find the area of the region enclosed by $y = x^4 - x$ and $y = x - x^2$.

- ① $\frac{1}{15}$ ② $\frac{1}{5}$ ③ $\frac{1}{3}$ ④ $\frac{7}{15}$ ⑤ $\frac{3}{5}$


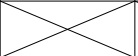
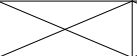
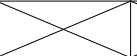
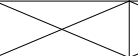
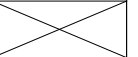
14. [6 points]

Find the volume of the solid obtained by rotating the region bounded by $y = \ln x$, $(1 \leq x \leq e)$, $x = e$ and the x -axis about the x -axis.

- ① $\pi(e-2)$ ② $\pi(e-1)$ ③ πe
④ $\pi(e+1)$ ⑤ $\pi(e+2)$

2022 IUT Admission Test (SOCIE) Answers

Type A

1	2	3	4	5	6	7	8	9	10
③	②	⑤	①	④	④	①	②	②	⑤
11	12	13	14	15	16	17	18	19	20
⑤	③	④	①						

2022 IUT Admission Test(SOCIE)

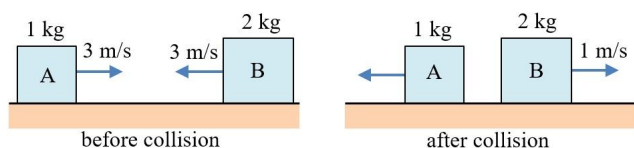
Physics Examination(A TYPE)

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

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1. [4 points]

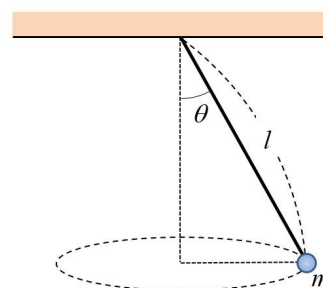
As shown in the figure, objects A and B with masses of 1 kg and 2 kg collide head-on with a speed of 3 m/s, respectively, and then move in opposite directions on a frictionless floor. The speed of B after the collision is 1 m/s. What is the speed of object A after the collision?



- ① 2 m/s
- ② 3 m/s
- ③ 4 m/s
- ④ 5 m/s
- ⑤ 6 m/s

2. [6 points]

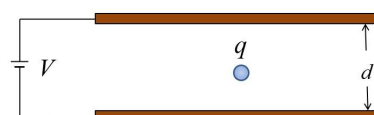
As shown in the figure, one end of the string of length $l = 10\text{ m}$ is fixed, and an object of mass $m = 2\text{ kg}$ is suspended at the other end to have a uniform circular motion in the horizontal plane. The string makes an angle $\theta = 30^\circ$ with the vertical line. What is the period of the object in circular motion? (Assume that the gravitational acceleration is $g = 10\text{ m/s}^2$, and air resistance is neglected)



- ① $2\pi\text{ s}$
- ② $2\sqrt{3}\pi\text{ s}$
- ③ $\sqrt{3}\pi\text{ s}$
- ④ $\sqrt{\sqrt{3}}\pi\text{ s}$
- ⑤ $\sqrt{2\sqrt{3}}\pi\text{ s}$

3. [5 points]

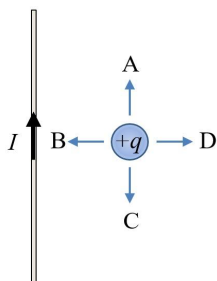
As shown in the figure, the potential difference between the two plates is $V = 3\text{ V}$, and the distance between parallel conductors is $d = 2\text{ cm}$. A particle with a charge of $q = -0.4\text{ C}$ is at rest under gravity and electric force. What is the mass of the particle? (Assume that the gravitational acceleration is $g = 10\text{ m/s}^2$)



- ① 2 kg
- ② 3 kg
- ③ 4 kg
- ④ 6 kg
- ⑤ 8 kg

4. [4 points]

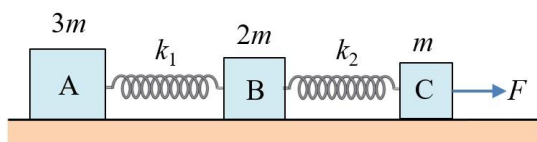
As shown in the figure, the current I flows upward in the straight wire. When a positively charged particle of $+q$ is incident in the same direction as the current, what is the direction of force that is exerted on this particle?



- ① A ② B ③ C
 ④ D ⑤ out of the page

5. [6 points]

Objects A, B, and C have masses of $3m$, $2m$, and m , respectively. The three objects are connected with two springs with spring constants k_1 and k_2 and placed on a frictionless horizontal surface as shown in the figure. When a force F is applied to object C in the horizontal direction, the three objects move with a constant acceleration, and the stretched lengths of the two springs are the same. What is the ratio of the two spring constants, $\frac{k_1}{k_2}$? (Here, the mass of the spring is ignored)



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

6. [5 points]

What is the position and size of the image produced when a 3-cm-long object is placed 60 cm in front of a concave mirror with a focal length of 20 cm?

- ① 20 cm, 1 cm ② 20 cm, 2 cm
 ③ 30 cm, 1.5 cm ④ 30 cm, 2 cm
 ⑤ 30 cm, 1 cm

Physics Examination(A TYPE) Answers

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Answers: 1. ④, 2. ⑤, 3. ④, 4. ②, 5. ①, 6. ③