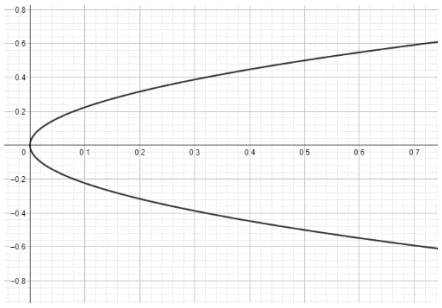
Egypt-Japan University of Science and Technology *Sample Entrance Exam (Undergraduate)*		
Computer Science and Information Technology Programs	**Subject: Mathematics**	
Academic Year: 2021/2022	**No. of Pages: 5**	
Exam Duration: 1 hr	**Exam Version:**	
Student Name:	**Student ID:**	

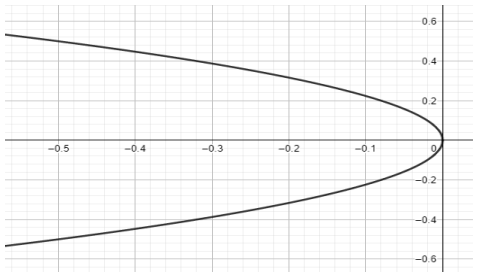
Choose the correct answer:

Question ① Which of the following graphs represents the function $x - 2y^2 = 0$?

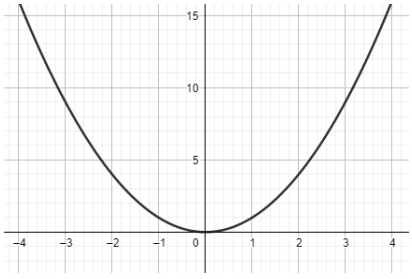
a)



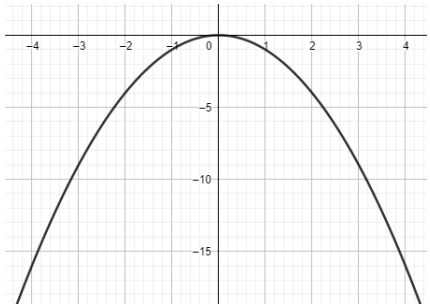
b)



c)

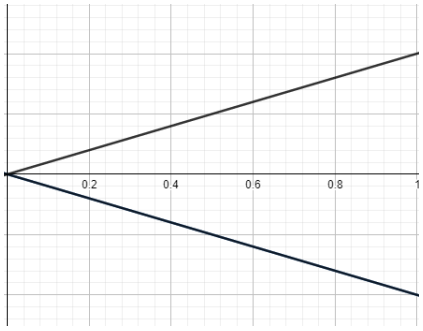


d)

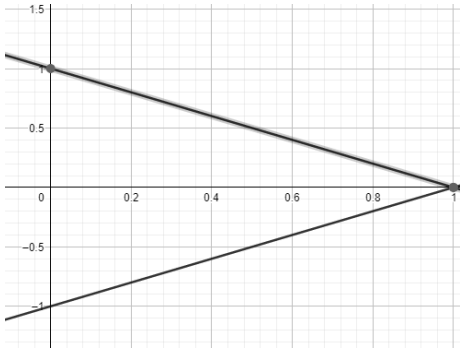


Question ② Which of the following graphs represents the function $1 - x - |y| = 0$?

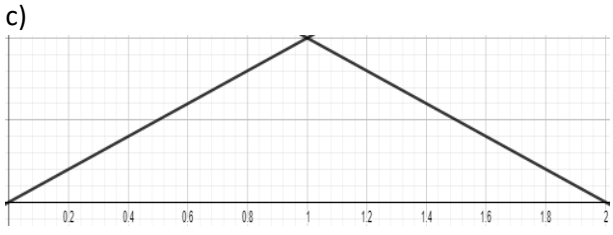
a)



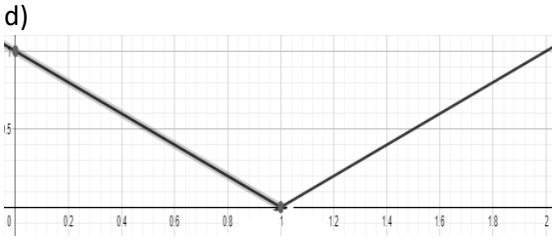
b)



c)



d)



Question ③ The term $4C_1\left(2\sqrt{t}\right)^3\left(-\frac{1}{t}\right)$ is the second term in the binomial expansion of

a) $\left(2\sqrt{t}-\frac{1}{t}\right)^4$

b) $\left(2\sqrt{t}-\frac{1}{t}\right)^3$

c) $\left(\sqrt{t}+\frac{1}{t}\right)^4$

d) $\left(\sqrt{t}-\frac{2}{t}\right)^4$

Question ④ A construction company builds new buildings at an increasing rate. In the first year only one building is built, in the second year two are built, and so on, with n buildings built in the nth year. What is the total number of buildings this company built in 12 years?

a) 30

b) 78

c) 102

d) 128

Let α and β be the two roots of the equation $x^2 - px + 1 = 0$.

Question ⑤ The value of $\alpha\beta$ equals:

a) p
b) 1
c) $-p$
d) -1

Question ⑥ The value of $\int_{-2}^{2}|x|\,dx$ is:

a) 0
b) 1
c) 2
d) 4

Let L be the tangent line to the graph $f(x) = e^x$ at $x = 0$.

Question ⑦ The equation of L is:

a) $y = x - 1$
b) $y = 2x + 1$
c) $y = x + 1$

d) $y = 2x - 1$

Question ⑧ L intersects the x-axis at $x =$

a) -2
b) -1
c) 1
d) 2

Consider $F(x) = \int_x^1 (3t^2 + 1)dt$.

Question ⑨ $F(x) =$

a) $-x^3 - x + 2$
b) $x^3 - x + 2$
c) $-x^3 + x + 2$
d) $x^3 - x - 2$

Question ⑩ The value of $F'(0)$ is:

a) 1
b) -1
c) 2
d) -2

Question ⑪ The value of $F(1)$ is:

a) 3
b) 1
c) 2
d) 0

Question ⑫ $\int \frac{2x}{x^2+1} dx$

a) $\ln(x^2 + 1) + c$
b) $\ln(x^3 + 1) + c$
c) $\ln(2x + 1) + c$
d) $\ln(x^2 + 2x) + c$

Question ⑬ $\int \frac{t}{\sqrt{t^2-1}} dt$

a) $\sqrt{t^2 - 1} + c$
b) $\frac{1}{\sqrt{t^2-1}} + c$
c) $(t^2 - 1)^{\frac{3}{2}} + c$
d) $(t^2 - 1)^{\frac{-3}{2}} + c$

Question ⑭ The value of $\sum_{k=0}^{\infty}\left(\frac{1}{2}\right)^{k}$ is:

a) $\frac{1}{2}$
b) 2
c) 1
d) $1\frac{1}{2}$

Question ⑮ A manufacturing process consists of 2 stages and each stage consists of 5 tasks. The first stage should be completed before starting the second stage. However, within any of the two stages, the tasks can be completed in any order. How many different task sequences are possible?

a) 100
b) 625
c) 10000
d) 14400

Question ⑯ A triangle ABC has side lengths AB = 5 cm, AC = 7 cm, and BC= 9 cm. Then cos(A) equals

a) 0.1
b) 0.633
c) -0.1
d) -0.633

Question ⑰ If the concentration (C) of a compound of a certain compoundin a chemical reaction is given by milligram in a liter by the relation $C(t)=\frac{15}{2t^{2}+15}$where t is the time. What is the concentration of C when time approaches infinity?

a) 0

b) 15

c) 5

d) 1

Question ⑱ The domain of the function $f(x)=\sqrt{2x-4}$ is given by

a) $[\frac{1}{2},\infty[$
b) $[-2,\infty[$
c) $]2,\infty[$
d) $[2,\infty[$

Question ⑲ The solution of the equation $\sqrt{x^{2}-6x+9}=9-2x$ is

a) $\{4,6\}$
b) $\{4,-6\}$
c) $\{4\}$
d) $\{6\}$

Question 20 If $f(x) = 2^x$, then the value of *x* that satisfies the equation $f(x) = f(5-x)^2$ is

a) $\{4,3\}$
b) $\{4,2\}$
c) $\{2,3\}$
d) $\{-2,-3\}$

Best Wishes for all

Important tables/formulas

Differentiation Formulas:

1. $\frac{d}{dx}(x) = 1$
2. $\frac{d}{dx}(ax) = a$
3. $\frac{d}{dx}(x^n) = nx^{n-1}$
4. $\frac{d}{dx}(\cos x) = -\sin x$
5. $\frac{d}{dx}(\sin x) = \cos x$
6. $\frac{d}{dx}(\tan x) = \sec^2 x$
7. $\frac{d}{dx}(\cot x) = -\csc^2 x$
8. $\frac{d}{dx}(\sec x) = \sec x \tan x$
9. $\frac{d}{dx}(\csc x) = -\csc x(\cot x)$
10. $\frac{d}{dx}(\ln x) = \frac{1}{x}$
11. $\frac{d}{dx}(e^x) = e^x$
12. $\frac{d}{dx}(a^x) = (\ln a)a^x$
13. $\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$
14. $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$
15. $\frac{d}{dx}(\sec^{-1} x) = \frac{1}{|x|\sqrt{x^2-1}}$

Integration Formulas:

1. $\int 1\,dx = x + C$
2. $\int a\,dx = ax + C$
3. $\int x^n dx = \frac{x^{n+1}}{n+1} + C,\ n \neq -1$
4. $\int \sin x\,dx = -\cos x + C$
5. $\int \cos x\,dx = \sin x + C$
6. $\int \sec^2 x\,dx = \tan x + C$
7. $\int \csc^2 x\,dx = -\cot x + C$
8. $\int \sec x(\tan x)\,dx = \sec x + C$
9. $\int \csc x(\cot x)\,dx = -\csc x + C$
10. $\int \frac{1}{x}dx = \ln|x| + C$
11. $\int e^x dx = e^x + C$
12. $\int a^x dx = \frac{a^x}{\ln a} + C\ a > 0,\ a \neq 1$
13. $\int \frac{1}{\sqrt{1-x^2}}dx = \sin^{-1} x + C$
14. $\int \frac{1}{1+x^2}dx = \tan^{-1} x + C$
15. $\int \frac{1}{|x|\sqrt{x^2-1}}dx = \sec^{-1} x + C$

Some additional integration formulas:

- $\int \frac{f'(x)}{f(x)}dx = \ln\big(f(x)\big) + C$
- $\int \frac{f'(x)}{\sqrt{f(x)}}dx = 2\sqrt{f(x)} + C$

Arithmetic sequence:

- General term: $a_k = a_1 + (k-1)\,d$
- Summation: $S_n = \sum_{k=1}^{n} a_k = \frac{n}{2}(a_1 + a_n) = \frac{n}{2}(2a + (n-1)d)$

Geometric sequence:

- General term: $a_k = a_1 r^{k-1}$
- Finite summation: $S_k = \sum_{k=1}^{n} a_k = \frac{a_1(1-r^n)}{1-r}$
- Infinite summation: $S_\infty = \sum_{k=1}^{\infty} a_k = \frac{a_1}{1-r}, \qquad |r| < 1$

Binomial theorem

- $(x+y)^n = a^n + C_1^n a^{n-1} b + C_2^n a^{n-2} b + \cdots + b^n$

Permutations*:* Number of ways of selecting *r* out of *n* objects taking order into consideration: $P_r^n = \frac{n!}{(n-r)!}$.

Combinations*:* Number of ways of selecting *r* out if *n* objects without taking order into consideration: $C_r^n = \frac{n!}{r!\,(n-r)!}$.