1) Given that x is not an integer, then $[-x]$,the integer function, is equal to

A) $[-x]$

B) $-[x]+1$

C) $[x]-1$

D) $[-x]-1$

2) If $f(x)=\begin{cases}\dfrac{x-1}{2x^2-7x+5}, & x\neq 1\\ \dfrac{1}{3}, & x=1\end{cases}$, then $f'(1)=$

A) $-\frac{1}{9}$

B) $-\frac{2}{9}$

C) $-\frac{1}{3}$

D) $\frac{1}{3}$

3) Let $g(x) = 1 + x - [x]$, where $[x]$ means the greatest integer less than or equal to x, and

$f(x)=\begin{cases}-1, & x<0\\ 0, & x=0\\ 1 & x>0\end{cases}$ then for all x, $f[g(x)]=$

A) x

B) 1

C) $f(x)$

D) $g(x)$

4) The function $f(x)=x\sin\frac{1}{x}$, $x\neq 0$ is continuous at $x=0$ provided $f(0)$ is defined as

A) $f(0) = 0$

B) $f(0) = \frac{1}{2}$

C) $f(0) = 1$

D) $f(0) = \frac{1}{\pi}$

5) If $f(x) = \cos x$, $0\leq x\leq\frac{\pi}{2}$, then the real the mean value of $f(x)$ is

A) $\frac{\pi}{6}$

B) $\frac{\pi}{4}$

C) $\sin^{-1}\left(\frac{2}{\pi}\right)$

D) $\cos^{-1}\left(\frac{2}{\pi}\right)$

6) $\int\frac{1}{e^x-1}dx$

A) e^x-1

B) $\ln\left(1-e^x\right)$

C) $\ln\left(e^x-1\right)$

D) $\tan^{-1}\left(e^x\right)$

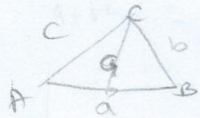
7) If A, B and C are vertices of a triangle whose position vectors are a, b and c and G is the centroid of $\triangle ABC$, then $\overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC} =$

A) $\frac{a+b+c}{3}$

B) $\frac{a+b+c}{2}$

C) 0

D) $a+b+c$



a + btc

8) For non-zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$, $\left|\left(\vec{a}\times\vec{b}\right)\cdot\vec{c}\right| = |\vec{a}||\vec{b}||\vec{c}|$ holds if and only if

A) $\vec{a}\cdot\vec{b}=0, \vec{b}\cdot\vec{c}=0$

B) $\vec{b}\cdot\vec{c}=0, \vec{c}\cdot\vec{a}=0$

C) $\vec{c}\cdot\vec{a}=0, \vec{a}\cdot\vec{b}=0$

D) $\vec{a}\cdot\vec{b}=\vec{b}\cdot\vec{c}=\vec{c}\cdot\vec{a}$

a · bc =
a b i c = bc · a = ca · b

9) The volume of the parallelepiped represented by sides $i-2j+3k, 3i+j+4k$ and $-2i+\mu j-k$ is 15, then the value of μ is

A) 3

B) 0

C) -3

D) 2

(i-2j+3k) 3

10) The differential equation of the family of curves $y = e^x(A\cos x + B\sin x)$ where A and B are arbitrary constants is

A) $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$

B) $\frac{d^2y}{dx^2}+2\frac{dy}{dx}-2y=0$

C) $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2+y=0$

D) $\frac{d^2y}{dx^2}-7\frac{dy}{dx}+2y=0$

m^2-2+2
$(m-1)(m-2)$
m^2+m^2
$m^2=1-m^2$
m^2+2m-2

m^2+2m-2
m^2+m^2+1
$2m^2=1$
$m^2=\frac{1}{2}$

11) $\frac{x^2}{(x-1)^2(x^2+1)}=$

x^2
$\frac{A}{(x-1)}+\frac{B}{(x-1)}+\frac{Cx+1+D}{(x^2+1)}$

A) $\frac{A}{x-1}+\frac{B}{(x-1)^2}+\frac{C}{x^2+1}$

B) $\frac{A}{x-1}+\frac{B}{x+1}+\frac{Cx}{x^2+1}$

C) $\frac{A}{x-1}+\frac{B}{x+1}+\frac{Cx+D}{x^2+1}$

D) $\frac{Ax+B}{(x-1)^2}+\frac{Cx+D}{x^2+1}$

12) $\sum_{n=1}^{\infty} \frac{1}{2n-1} x^{2n} =$

A) $\dfrac{-n}{(1-\omega)^2}$

B) $\dfrac{1}{2}\ln\left(\dfrac{1+x^2}{1-x^2}\right)$

C) $x\ln\left(\dfrac{1+x}{1-x}\right)$

D) $\dfrac{1}{2}\ln\left(\dfrac{1+x}{1-x}\right)$

13) If ω is the n^{th} root of unity, then $1+2\omega+3\omega^2+\ldots$ to n terms is equal to

A) $\dfrac{-n}{(1-\omega)^2}$

B) $\dfrac{-n}{1-\omega}$

C) $\dfrac{-2n}{1-\omega}$

D) $\dfrac{-2n}{(1-\omega)^2}$

14) $\int \frac{\ln x^2}{x} =$

A) $(\ln x)^2 + c$

B) $(\ln x^2)^2 + c$

C) $\ln x^2 + c$

D) $\ln x + c$

15) The expansion $\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \ldots\infty$ is valid for

A) all real x

B) $-1 < x < 1$

C) $-1 < x \le 1$

D) $-1 \le x \le 1$

16) The solution of the equation $|z| - 3 = 1 + 2i$ is

A) $\frac{3}{2} - 2i$

B) $\frac{3}{2} + 2i$

C) $2 - \frac{3}{2}i$

D) does not exist

17) Given that $z = \frac{1+i\sqrt{3}}{1-i\sqrt{3}}$, then z^{20} in the form $a+ib$, where a and b are real numbers is

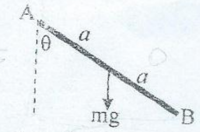
A) $-\frac{\sqrt{3}}{2} - \frac{1}{2}i$

B) $-\frac{\sqrt{3}}{2} + \frac{1}{2}i$

C) $\frac{\sqrt{3}}{2} - \frac{1}{2}i$

D) $\frac{\sqrt{3}}{2} + \frac{1}{2}i$

18)



The rod AB is pivoted at A and can rotate freely about a horizontal plane, is released from rest in the position shown in the diagram. The angular velocity of the rod AB when B is vertically below A is

A) $\sqrt{\frac{4a}{3g}}$

B) $\sqrt{\frac{3g}{4a}}$

C) $\sqrt{\frac{g}{a}}$

D) $\frac{3g}{4a}$

19) The range of values of x for which the expansion of $\ln(2-5x-3x^2)$ is valid is

A) $-\frac{1}{3}\leq x\leq\frac{1}{3}$

B) $-\frac{1}{3}\leq x<\frac{1}{3}$

C) $-\frac{1}{3}<x\leq\frac{1}{3}$

D) $-\frac{1}{3}<x<\frac{1}{3}$

np

20) Given that a coin is tossed 80 times, then the mean and variance of the number of heads respectively are

A) 80, 40

B) 40, 20

C) 20, 40

D) 20, 10

21) The unit vector which is perpendicular to each of the vectors $a=i-j+2k$ and $b=-i+2j+k$ is

A) $-5i-3j+k$

B) $\frac{1}{35}(5i+3j-k)$

C) $\frac{1}{\sqrt{35}}(-5i-3j+k)$

D) $-5i-3j+k$

2) The cofactor of the entry 7 in the matrix $\begin{vmatrix} 2 & 3 & -1 \\ 7 & 4 & 0 \\ 6 & 9 & 8 \end{vmatrix}$ is

3, 3

A) $\begin{vmatrix} 3 & -1 \\ 9 & 8 \end{vmatrix}$

B) $-\begin{vmatrix} 3 & -1 \\ 9 & 8 \end{vmatrix}$

C) $\begin{pmatrix} 3 & -1 \\ 9 & 8 \end{pmatrix}$

D) $-\begin{pmatrix} 3 & -1 \\ 9 & 8 \end{pmatrix}$

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23) A particle travelling with retardation $(1+v^2)$N in a straight line, where v m/s is its speed, has initial velocity um/s. The particle comes to rest in the time

A) $\frac{u}{2}$ sec.

B) $\frac{1}{2}\tan^{-1}u$ sec

C) $\tan^{-1}u$ sec

D) $\tan^{-1}\frac{u}{2}$ sec.

$m\frac{dv}{dt} = 1+v^2$

$\int_u^0 \frac{dv}{1+v^2} = \int dt$

$\tan^{-1} 0^2 - \tan^{-1} u$

24) The general solution, of the vector differential equation $\frac{d^2\mathbf{r}}{dt^2}+2\frac{d\mathbf{r}}{dt}+2\mathbf{r}=0$, is

A) $\mathbf{r}=e^{t}(A\cos t+B\sin t)$

B) $\mathbf{r}=-e^{-t}(A\cos t+B\sin t)$

C) $\mathbf{r}=e^{-t}(A\cos t+B\sin t)$

D) $\mathbf{r}=-e^{t}(A\cos t+B\sin t)$

$m^2+2m+2=0$

25) Given that the moment of inertia about an axis through the centre of a uniform solid sphere of mass m and radius a is $\frac{2ma^2}{5}$, then the moment of inertia of the sphere about a tangent is

A) $\frac{7ma^2}{5}$

B) $\frac{5ma^2}{7}$

C) $\frac{7ma}{5}$

D) $\frac{5ma}{7}$

26) The rate of decay of a substance is cx, where x is the amount of the substance remaining and c a constant. The time, t, in which the amount of the substance is halved is

A) $t = c\ln 2$

B) $t = \frac{1}{2}\ln 2$

C) $t = \ln 2c$

D) $t = \frac{1}{c}\ln 2$

$t_{1/2} = \frac{\ln 2}{c}$

27) The first two terms of the Maclaurin series expansion $e^x \cos x$ are

A) $x+\frac{1}{2}x^2$

B) $1+x$

C) $x+\frac{1}{3}x^2$

D) $1+\frac{1}{2}x^2$

$f(0) + xf'(0)$

$1+x$

28) $\lim\limits_{x\to\infty} \frac{1-e^x}{\sin x}$ is

A) -1

B) 0

C) 1

D) 2

29) The table gives the values of x and their corresponding values of y of a continuous function $y=f(x)$

	y_0	y_1	y_2	y_3	y_4
x	3	3.5	4	4.5	5.0
y	5.4	4.6	4.2	4.1	4.7

An approximate value of $\int_3^5 f(x)dx$ using the Simpson's rule is:

A) 26.65
B) 44.5
C) 89.0
D) 8.95

30) $e^{(2-2i)\theta} =$

A) $e^{2\theta} + i\sin 2\theta$
B) $\cos 2\theta - i\sin 2\theta$
C) $e^{2\theta}(\cos 2\theta - i\sin 2\theta)$
D) $e^{2\theta}(\cos 2\theta + i\sin 2\theta)$

31) The solution of the equation $\cosh x - \sinh x - 1 = 0$ is

A) 2
B) 1
C) $\frac{1}{2}$
D) 0

32) A force F acts at the point, with position vector r, where $F = (3i - 4j + k)$ N and $r = (2i - j - k)m$.
The vector moment of F about the origin is

A) -5i - 5j - 5k
B) 5i - 5j - 5k
C) -5i + 5j - 5k
D) $5i - 5j + 5k$

33) The kinetic energy and moment of momentum of a flywheel whose moment of inertia is I and rotating at ω^2 rads^{-1} are respectively

A) $\frac{1}{2}I\omega^2$, $\frac{1}{2}I\omega^2$
B) $\frac{1}{2}I\omega^4$, $I\omega^2$
C) $\frac{1}{2}I\omega^2$, $I\omega$
D) $\frac{1}{2}I\omega^4$, $I\omega$

4) Given the plane $2x - y + z$ and the line $r = i + 2j - k + \lambda(i - j + k)$, the sine of the angle between them is

A) $\frac{\sqrt{2}}{3}$
B) $\frac{\sqrt{3}}{2}$
C) $\frac{\sqrt{6}}{5}$
D) $\frac{\sqrt{3}}{4}$

5) Gi n the approximation $y_{n+1} = y_n + h\left(\frac{dy}{dx}\right)$ and a step of 0.1, given that $\frac{dy}{dx} = xy$, and $y = 1$ when $x = 0$ the value of y when $x = 0.1$ is

A) 1.01
B) 1
C) 0.2
D) 1.1

$x_{n+1} = x_n + 0.1$
$x_1 = 0.1$
$y_{n+1} = y_n + 0.1(x_0 y_0)$
$y_1 = 1$

36) The equation of the image of the line $2y = x$ under the transformation $T = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ is

A) $y=\frac{1}{2}x$

B) $y=x^2$

C) $y=2x$

D) $y=x^{\frac{1}{2}}$

$y = x$
$y = \frac{1}{3}x$

37) The curve with polar equation $r\cos\theta = b$ is

A) a circle radius b

B) a straight line $x = b$

C) a straight line $y = b$

D) a cardioids

$r\cos\theta = b$

38) Two groups **G** and **H** are epimorphic if

A) there is a bijection from **G** to **H**

B) there is a surjection from **G** to **H**

C) there is an injection from **G** to **H**

D) G is a subgroup of H

$b^2 = a^2(e^2-1)$
$9 = 16(e^2-1)$
$9 = 16e^2 - 16$
$16e^2 - 25$

$16e^2 = 25$
$e^2 = \frac{25}{16}$
$e = \frac{\sqrt{25}}{\sqrt{4}} = \frac{5}{4}$

39) Given that $\frac{x^2}{16} - \frac{y^2}{9} = 1$ is the equation of a hyperbola, then the foci are

A) $(\frac{3}{4},0),(-\frac{3}{4},0)$

B) $(5, 0), (-5, 0)$

C) $(4, 3),(-4, -3)$

D) $(\frac{45}{4},0), (-\frac{45}{4}, 0)$

$\frac{x^2}{a^2} + \frac{y^2}{y^2}$ $4 \times \frac{5}{4}$ $4, -4$ 5

40) $\lim_{x\to 0}\frac{\sinh x}{\sin x}$

A) 0

B) 1

C) $\frac{1}{2}e$

D) e

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end