# NEST Mathematics Sample Paper – 3

**Duration: 45 Minutes** **Maximum Marks: 60**

## Instructions

- This paper contains **20 Multiple Choice Questions (single correct answer)**, modelled on the Mathematics section of **NEST 2026**.
- Each correct answer carries **+3 marks**. There is a deduction of $-1$ **mark** for each incorrect answer; **no marks** are deducted for an unattempted question.
- Every question has exactly **four options**, of which only **one** is correct. Choose carefully.
- Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited in the examination hall.
- A simple on-screen (virtual) calculator is provided in the computer-based test interface and may be used; blank sheets for rough work are supplied at the exam centre.

**Q1.** The range of the real-valued function $f(x) = \frac{x^2}{1+x^2}$, defined for all real $x$, is

(A) $[0, 1]$

(B) $[0, 1)$

(C) $(0, 1)$

(D) $(0, 1]$

**Q2.** The number of solutions of the equation $2\sin^2 x - 3\sin x + 1 = 0$ in the interval $[0, 2\pi]$ is

(A) 2

(B) 3

(C) 4

(D) 5

**Q3.** For the quadratic equation $x^2 - 2x + 5 = 0$, the nature of the roots is

(A) real and distinct

(B) real and equal

(C) real and rational

(D) complex conjugates (non-real)

**Q4.** The number of ways in which 7 distinct persons can be seated around a circular table is

(A) 720

(B) 5040

(C) 5760

(D) 120

**Q5.** The sum of all the binomial coefficients in the expansion of $(1+x)^{10}$ (that is, $\sum_{r=0}^{10} \binom{10}{r}$) is

(A) 100

(B) 512

(C) 1024

(D) 2048

**Q6.** If the arithmetic mean of two positive numbers is 10 and their geometric mean is 8, then the two numbers are

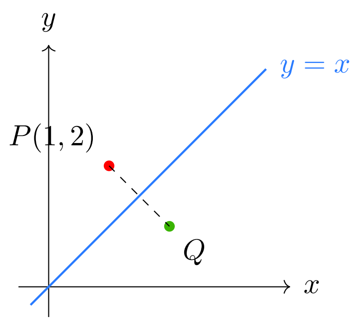
(A) 2 and 18

(B) 6 and 14

(C) 5 and 15

(D) 4 and 16

**Q7.** The image (reflection) of the point $P(1,2)$ in the line $y = x$ is the point $Q$ shown below. The coordinates of $Q$ are



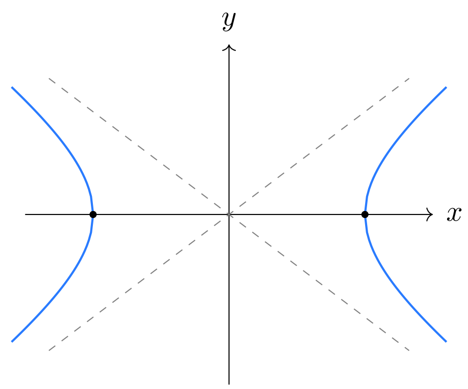

(A) $(1,-2)$

(B) $(2,1)$

(C) $(-1,2)$

(D) $(-2,-1)$

**Q8.** For the hyperbola $\dfrac{x^2}{16} - \dfrac{y^2}{9} = 1$ shown below, the eccentricity is




(A) $\dfrac{5}{4}$

(B) $\dfrac{4}{3}$

(C) $\dfrac{3}{4}$

(D) $\dfrac{5}{3}$

**Q9.** The value of $\lim\limits_{x \to 0} \dfrac{\sin 5x}{\sin 3x}$ is

(A) $\frac{3}{5}$

(B) $1$

(C) $\frac{5}{3}$

(D) $\frac{15}{1}$

**Q10.** A data set has mean $20$ and variance $16$. If every observation is multiplied by $3$ and then $5$ is added, the new mean and new variance are respectively

(A) $65$ and $48$

(B) $65$ and $144$

(C) $60$ and $144$

(D) $65$ and $21$

**Q11.** The value of $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{3}$ is

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{2}$

(D) $\frac{\pi}{6}$

**Q12.** The matrix $A = \begin{pmatrix} 2 & 4 \\ 1 & k \end{pmatrix}$ fails to be invertible (is singular) for the value of $k$ equal to

(A) $0$

(B) $1$

(C) $4$

(D) $2$

**Q13.** If a $3 \times 3$ determinant has value $D$, and a new determinant is formed by multiplying every entry of one row by $4$, then the value of the new determinant is

(A) $D$

(B) $64D$

(C) $4D$

(D) $12D$

**Q14.** If $x = t^2$ and $y = t^3$, then $\frac{dy}{dx}$ at the point where $t = 2$ is

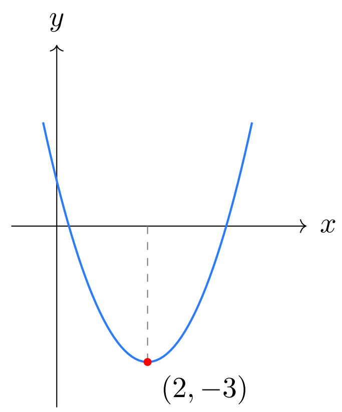
(A) $2$

(B) $3$

(C) $\frac{3}{2}$

(D) $6$

**Q15.** The function $f(x) = x^2 - 4x + 1$, whose graph is shown, is strictly increasing on the interval




(A) $(-\infty, 2)$

(B) $(-\infty, 0)$

(C) $(0, 2)$

(D) $(2, \infty)$

**Q16.** The value of the indefinite integral $\int x\, e^x\, dx$ is (with $C$ an arbitrary constant)

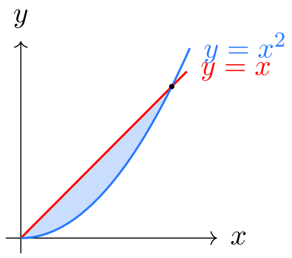
(A) $(x-1)e^x + C$

(B) $(x+1)e^x + C$

(C) $x\,e^x + C$

(D) $\dfrac{x^2}{2}e^x + C$

**Q17.** The area of the shaded region enclosed between the curve $y = x^2$ and the line $y = x$ (for $0 \le x \le 1$), as shown, is




(A) $\dfrac{1}{2}$

(B) $\dfrac{1}{3}$

(C) $\dfrac{1}{6}$

(D) $\dfrac{2}{3}$

**Q18.** The integrating factor of the linear differential equation $\dfrac{dy}{dx} + \dfrac{2}{x}y = x^2$ (for $x > 0$) is

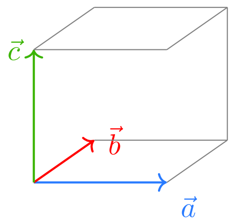
(A) $x$

(B) $x^2$

(C) $e^{2x}$

(D) $\dfrac{1}{x^2}$

**Q19.** The volume of the parallelepiped whose three coterminous edges are the vectors $\vec{a} = 2\hat{\imath}$, $\vec{b} = 3\hat{\jmath}$ and $\vec{c} = 4\hat{k}$, as shown, is




(A) 9

(B) 12

(C) 20

(D) 24

**Q20.** A fair coin is tossed 5 times. The probability of getting exactly 3 heads is

(A) $\frac{5}{16}$

(B) $\frac{3}{16}$

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

(D) $\frac{5}{32}$

## Detailed Solutions

### Q1.

**Solution**

**Concept — Range of a rational function:** Set $y = f(x)$, solve for $x$ in terms of $y$, and require the expression under any square root (or denominator) to be admissible for real $x$.

**Step 1 — Solve for $x^2$:** Let $y = \frac{x^2}{1+x^2}$. Then $y(1+x^2) = x^2 \Rightarrow x^2(1-y) = y \Rightarrow x^2 = \frac{y}{1-y}$.

**Step 2 — Admissibility:** Since $x^2 \geq 0$ we need $\frac{y}{1-y} \geq 0$, which holds for $0 \leq y < 1$. The value $y = 1$ is excluded (it would need $x^2 = \infty$); $y = 0$ is attained at $x = 0$.

**Why other options are wrong:**

- (A) $[0, 1]$ wrongly includes $y = 1$, which is only a horizontal asymptote.
- (C) $(0, 1)$ omits $y = 0$, but $f(0) = 0$ is attained.
- (D) $(0, 1]$ both drops $0$ and wrongly adds $1$.

**Final Answer:** Range $= [0, 1) \Rightarrow \boxed{B}$

**Answer: (B)** Go Back to Q1

### Q2.

**Solution**

**Concept — Trigonometric equation by substitution:** Put $s = \sin x$, solve the quadratic in $s$, then count the values of $x$ in the interval for each admissible $s$.

**Step 1 — Factor:** $2s^2 - 3s + 1 = 0 \Rightarrow (2s-1)(s-1) = 0 \Rightarrow s = \frac{1}{2}$ or $s = 1$.

**Step 2 — Count solutions in $[0, 2\pi]$:** $\sin x = \frac{1}{2}$ gives $x = \frac{\pi}{6}, \frac{5\pi}{6}$ (two solutions). $\sin x = 1$ gives $x = \frac{\pi}{2}$ (one solution). Total $= 3$.

**Why other options are wrong:**

- (A) $2$ misses one of the two solutions of $\sin x = \frac{1}{2}$.
- (C) $4$ wrongly counts $\sin x = 1$ twice.
- (D) $5$ over-counts both cases.

**Final Answer:** There are $3$ solutions $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q2

## Q3.

### Solution

**Concept — Discriminant:** For $ax^2 + bx + c = 0$, the discriminant $\Delta = b^2 - 4ac$ decides the nature of the roots: $\Delta > 0$ real distinct, $\Delta = 0$ real equal, $\Delta < 0$ non-real (complex conjugates).

**Step 1 — Compute $\Delta$:** Here $a = 1$, $b = -2$, $c = 5$, so $\Delta = (-2)^2 - 4(1)(5) = 4 - 20 = -16$.

**Step 2 — Interpret:** $\Delta = -16 < 0$, so the roots are non-real and occur as a conjugate pair, namely $x = 1 \pm 2i$.

**Why other options are wrong:**

- (A) real and distinct needs $\Delta > 0$.
- (B) real and equal needs $\Delta = 0$.
- (C) real and rational needs $\Delta$ a perfect square ($\geq 0$).

**Final Answer:** $\Delta = -16 < 0$, roots are complex conjugates $\Rightarrow$ $\boxed{D}$

Answer: (D) Go Back to Q3

## Q4.

### Solution

**Concept — Circular permutations:** The number of distinct arrangements of $n$ distinct objects around a circle is $(n - 1)!$, because rotations of the same arrangement are not counted separately.

**Step 1 — Apply formula:** With $n = 7$, the count is $(7 - 1)! = 6!$.

**Step 2 — Evaluate:** $6! = 720$.

**Why other options are wrong:**

- (B) $5040 = 7!$ counts linear (in-a-row) arrangements, ignoring rotational equivalence.
- (C) $5760$ is not a factorial value here.
- (D) $120 = 5!$ corresponds to $n = 6$ persons.

**Final Answer:** $(7 - 1)! = 720 \Rightarrow$ $\boxed{A}$

Answer: (A) Go Back to Q4

## Q5.

### Solution

**Concept — Sum of binomial coefficients:** Putting $x = 1$ in $(1 + x)^n$ gives $\sum_{r=0}^{n} \binom{n}{r} = 2^n$.

**Step 1 — Set $x = 1$:** $(1 + 1)^{10} = 2^{10}$.

**Step 2 — Evaluate:** $2^{10} = 1024$.

**Why other options are wrong:**

- (A) $100$ confuses the sum with $n^2$ or similar.
- (B) $512 = 2^9$ uses $n = 9$.
- (D) $2048 = 2^{11}$ uses $n = 11$.

**Final Answer:** $\sum_{r=0}^{10} \binom{10}{r} = 2^{10} = 1024 \Rightarrow \boxed{C}$

Answer: (C) Go Back to Q5

## Q6.

### Solution

**Concept — AM and GM of two numbers:** For numbers $a, b$, $\text{AM} = \dfrac{a+b}{2}$ and $\text{GM} = \sqrt{ab}$. Thus $a + b = 2(\text{AM})$ and $ab = (\text{GM})^2$.

**Step 1 — Sum and product:** $a + b = 2(10) = 20$ and $ab = 8^2 = 64$.

**Step 2 — Form and solve the quadratic:** $a, b$ are roots of $t^2 - 20t + 64 = 0 \Rightarrow (t - 4)(t - 16) = 0 \Rightarrow t = 4, 16$.

**Why other options are wrong:**

- (A) $2, 18$: sum $20$ but product $36 \neq 64$.
- (B) $6, 14$: product $84 \neq 64$.
- (C) $5, 15$: product $75 \neq 64$.

**Final Answer:** The numbers are $4$ and $16 \Rightarrow \boxed{D}$

Answer: (D) Go Back to Q6

# Q7.

## Solution

**Concept — Reflection in the line $y = x$:** The mirror image of a point $(a, b)$ in the line $y = x$ is obtained by interchanging the coordinates, giving $(b, a)$.

**Step 1 — Swap coordinates:** For $P(1, 2)$, the image is $Q(2, 1)$.

**Step 2 — Check:** The midpoint of $PQ$ is $\left(\frac{1+2}{2}, \frac{2+1}{2}\right) = (1.5, 1.5)$, which lies on $y = x$, and $PQ$ has slope $-1$, perpendicular to the mirror. Consistent.

**Why other options are wrong:**

- (A) $(1, -2)$ is the reflection in the $x$-axis.
- (C) $(-1, 2)$ is the reflection in the $y$-axis.
- (D) $(-2, -1)$ is the reflection through the origin.

**Final Answer:** $Q = (2, 1) \Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q7

# Q8.

## Solution

**Concept — Eccentricity of a hyperbola:** For $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$, we have $b^2 = a^2(e^2 - 1)$, so $e = \sqrt{1 + \dfrac{b^2}{a^2}}$; the asymptotes are $y = \pm\dfrac{b}{a}x$.

**Step 1 — Identify $a, b$:** $a^2 = 16,\ b^2 = 9$, so $a = 4,\ b = 3$.

**Step 2 — Eccentricity:** $e = \sqrt{1 + \dfrac{9}{16}} = \sqrt{\dfrac{25}{16}} = \dfrac{5}{4}$. (The asymptotes are $y = \pm\frac{3}{4}x$, the dashed lines shown.)

**Why other options are wrong:**

- (B) $\frac{4}{3}$ wrongly uses $e = \frac{a}{b}$.
- (C) $\frac{3}{4}$ is the asymptote slope $b/a$, not $e$.
- (D) $\frac{5}{3}$ would come from swapping $a^2$ and $b^2$.

**Final Answer:** $e = \dfrac{5}{4} \Rightarrow \boxed{\text{A}}$

**Answer: (A)** Go Back to Q8

## Q9.

**Solution**

**Concept — Standard trig limit:** Using $\lim_{x\to 0}\frac{\sin x}{x} = 1$, we write $\sin(kx) \approx kx$ near 0, so $\frac{\sin(kx)}{x} \to k$.

**Step 1 — Rewrite:** $\frac{\sin 5x}{\sin 3x} = \frac{\sin 5x}{5x}\cdot\frac{3x}{\sin 3x}\cdot\frac{5x}{3x}$.

**Step 2 — Take the limit:** As $x \to 0$ the first two factors tend to 1, leaving $\frac{5}{3}$.

**Why other options are wrong:**

- (A) $\frac{3}{5}$ inverts the ratio of arguments.
- (B) 1 ignores the different multipliers 5 and 3.
- (D) 15 multiplies the arguments instead of dividing.

**Final Answer:** $\lim_{x\to 0}\frac{\sin 5x}{\sin 3x} = \frac{5}{3} \Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q9

## Q10.

**Solution**

**Concept — Change of scale and origin:** If $y = ax + b$, then $\bar{y} = a\bar{x} + b$ and $\mathrm{Var}(y) = a^2\,\mathrm{Var}(x)$. Adding a constant shifts the mean but leaves variance unchanged; scaling multiplies the variance by the square of the factor.

**Step 1 — New mean:** $\bar{y} = 3(20) + 5 = 65$.

**Step 2 — New variance:** $\mathrm{Var}(y) = 3^2 \times 16 = 9 \times 16 = 144$. (The added 5 does not affect variance.)

**Why other options are wrong:**

- (A) 48 multiplies variance by 3 instead of $3^2$.
- (C) mean 60 forgets to add 5.
- (D) 21 adds 5 to the variance, which scaling/shift never does.

**Final Answer:** mean $= 65$, variance $= 144 \Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q10

## Q11.

**Solution**

**Concept — Addition formula for arctangent:** If $xy < 1$, then $\tan^{-1} x + \tan^{-1} y = \tan^{-1} \dfrac{x+y}{1-xy}$.

**Step 1 — Apply with** $x = \frac{1}{2},\ y = \frac{1}{3}$**:** Here $xy = \frac{1}{6} < 1$, so

$$\tan^{-1}\tfrac{1}{2} + \tan^{-1}\tfrac{1}{3} = \tan^{-1}\frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{6}} = \tan^{-1}\frac{\frac{5}{6}}{\frac{5}{6}} = \tan^{-1} 1.$$

**Step 2 — Evaluate:** $\tan^{-1} 1 = \dfrac{\pi}{4}$.

**Why other options are wrong:**

- (B) $\frac{\pi}{3}$ corresponds to $\tan^{-1}\sqrt{3}$, not $\tan^{-1} 1$.
- (C) $\frac{\pi}{2}$ would need the argument to diverge ($1 - xy = 0$).
- (D) $\frac{\pi}{6}$ corresponds to $\tan^{-1}\frac{1}{\sqrt{3}}$.

**Final Answer:** $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{3} = \dfrac{\pi}{4} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q11

## Q12.

**Solution**

**Concept — Invertibility of a matrix:** A square matrix $A$ has an inverse if and only if $\det A \neq 0$. It is singular (no inverse) exactly when $\det A = 0$.

**Step 1 — Determinant:** $\det A = \begin{vmatrix} 2 & 4 \\ 1 & k \end{vmatrix} = 2k - 4.$

**Step 2 — Set to zero:** $2k - 4 = 0 \Rightarrow k = 2$. For this value the matrix is singular and the inverse fails to exist.

**Why other options are wrong:**

- (A) $k = 0$ gives $\det A = -4 \neq 0$ (invertible).
- (B) $k = 1$ gives $\det A = -2 \neq 0$.
- (C) $k = 4$ gives $\det A = 4 \neq 0$.

**Final Answer:** $A$ is singular when $k = 2 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q12

## Q13.

**Solution**

**Concept — Scaling a row of a determinant:** If every element of one row (or column) of a determinant is multiplied by a scalar $k$, the value of the determinant is multiplied by $k$ (only once, not by $k^n$).

**Step 1 — Apply the property:** Multiplying one row by $4$ multiplies the determinant by $4$.

**Step 2 — Result:** New value $= 4D$.

**Why other options are wrong:**

- (A) $D$ ignores the scaling factor.
- (B) $64D = 4^3D$ wrongly applies $k$ to all three rows.
- (D) $12D$ has no basis (mixes the factor with the order $3$).

**Final Answer:** New determinant $= 4D \Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q13

## Q14.

**Solution**

**Concept — Parametric differentiation:** For $x = x(t),\ y = y(t)$, the chain rule gives $\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$.

**Step 1 — Derivatives in $t$:** $\frac{dx}{dt} = 2t$ and $\frac{dy}{dt} = 3t^2$.

**Step 2 — Form and evaluate:** $\frac{dy}{dx} = \frac{3t^2}{2t} = \frac{3t}{2}$. At $t = 2$, $\frac{dy}{dx} = \frac{3(2)}{2} = 3$.

**Why other options are wrong:**

- (A) $2$ uses $dx/dt$ alone.
- (C) $\frac{3}{2}$ forgets to substitute $t = 2$ (the value of $3t/2$ at $t = 1$).
- (D) $6$ takes $3t$ without dividing by $2$.

**Final Answer:** $\left.\frac{dy}{dx}\right|_{t=2} = 3 \Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q14

## Q15.

**Solution**

**Concept — Monotonicity via the first derivative:** A function is strictly increasing where $f'(x) > 0$ and strictly decreasing where $f'(x) < 0$.

**Step 1 — Differentiate:** $f(x) = x^2 - 4x + 1 \Rightarrow f'(x) = 2x - 4$.

**Step 2 — Sign analysis:** $f'(x) > 0 \iff 2x - 4 > 0 \iff x > 2$. So $f$ is strictly increasing on $(2, \infty)$ (and decreasing on $(-\infty, 2)$), with the turning point at the vertex $(2, -3)$ shown.

**Why other options are wrong:**

- (A) $(-\infty, 2)$ is where $f$ is decreasing.
- (B) $(-\infty, 0)$ lies entirely in the decreasing region.
- (C) $(0, 2)$ is also part of the decreasing region.

**Final Answer:** $f$ is strictly increasing on $(2, \infty) \Rightarrow \boxed{\text{D}}$

**Answer: (D)** Go Back to Q15

## Q16.

**Solution**

**Concept — Integration by parts:** $\displaystyle\int u\,dv = uv - \int v\,du$. Choose $u$ (algebraic) and $dv$ by the ILATE preference.

**Step 1 — Choose parts:** Take $u = x \Rightarrow du = dx$ and $dv = e^x\,dx \Rightarrow v = e^x$.

**Step 2 — Apply and finish:**

$$\int x\,e^x\,dx = x\,e^x - \int e^x\,dx = x\,e^x - e^x + C = (x-1)e^x + C.$$

Check: $\dfrac{d}{dx}\left[(x-1)e^x\right] = e^x + (x-1)e^x = xe^x$. Correct.

**Why other options are wrong:**

- (B) $(x+1)e^x$ has a sign error in the $\int v\,du$ term.
- (C) $xe^x$ omits the by-parts correction entirely.
- (D) $\frac{x^2}{2}e^x$ treats $e^x$ as a constant.

**Final Answer:** $(x-1)e^x + C \Rightarrow \boxed{\text{A}}$

**Answer: (A)** Go Back to Q16

## Q17.

### Solution

**Concept — Area between two curves:** On $[a, b]$ where one curve lies above the other, the enclosed area is $\int_a^b (y_{\text{top}} - y_{\text{bottom}})\,dx$.

**Step 1 — Order the curves:** On $0 \le x \le 1$, the line $y = x$ lies above the parabola $y = x^2$ (e.g. at $x = \frac{1}{2}$, $0.5 > 0.25$).

**Step 2 — Integrate:**

$$A = \int_0^1 (x - x^2)\,dx = \left[\frac{x^2}{2} - \frac{x^3}{3}\right]_0^1 = \frac{1}{2} - \frac{1}{3} = \frac{1}{6}.$$

**Why other options are wrong:**

- (A) $\frac{1}{2}$ is the area under $y = x$ alone.
- (B) $\frac{1}{3}$ is the area under $y = x^2$ alone.
- (D) $\frac{2}{3}$ adds the two areas instead of subtracting.

**Final Answer:** Area $= \frac{1}{6} \Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q17

## Q18.

### Solution

**Concept — Integrating factor:** For a linear ODE $\frac{dy}{dx} + P(x)\,y = Q(x)$, the integrating factor is $\mu = e^{\int P\,dx}$.

**Step 1 — Identify $P$:** Here $P(x) = \frac{2}{x}$.

**Step 2 — Compute $\mu$:** $\int P\,dx = \int \frac{2}{x}\,dx = 2\ln x = \ln x^2$, so $\mu = e^{\ln x^2} = x^2$ (using $x > 0$).

**Why other options are wrong:**

- (A) $x$ uses $\int \frac{1}{x}\,dx$, dropping the factor 2.
- (C) $e^{2x}$ wrongly integrates 2 instead of $\frac{2}{x}$.
- (D) $\frac{1}{x^2} = e^{-\ln x^2}$ has the wrong sign in the exponent.

**Final Answer:** Integrating factor $= x^2 \Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q18

## Q19.

### Solution

**Concept — Scalar triple product as volume:** The volume of a parallelepiped with coterminous edges $\vec{a}, \vec{b}, \vec{c}$ is $V = \left|[\vec{a}\ \vec{b}\ \vec{c}]\right| = \left|\vec{a} \cdot (\vec{b} \times \vec{c})\right|$, equal to the absolute value of the determinant of their components.

**Step 1 — Form the determinant:**

$$[\vec{a}\ \vec{b}\ \vec{c}] = \begin{vmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{vmatrix} = 2 \cdot 3 \cdot 4 = 24.$$

**Step 2 — Volume:** Since the three vectors are mutually perpendicular, $V = 2 \times 3 \times 4 = 24$ cubic units.

**Why other options are wrong:**

- (A) $9$ is $3^2$, an unrelated value.
- (B) $12$ uses only two of the three edge lengths.
- (C) $20$ does not match the product $2 \cdot 3 \cdot 4$.

**Final Answer:** $V = 24 \Rightarrow \boxed{\text{D}}$

**Answer: (D)** Go Back to Q19

## Q20.

### Solution

**Concept — Binomial distribution (Bernoulli trials):** For $n$ independent trials with success probability $p$, $P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$.

**Step 1 — Set parameters:** A fair coin gives $p = \frac{1}{2}$, $n = 5$, $k = 3$.

**Step 2 — Compute:**

$$P(X = 3) = \binom{5}{3} \left(\tfrac{1}{2}\right)^3 \left(\tfrac{1}{2}\right)^2 = 10 \cdot \left(\tfrac{1}{2}\right)^5 = \frac{10}{32} = \frac{5}{16}.$$

**Why other options are wrong:**

- (B) $\frac{3}{16}$ uses a wrong coefficient (not $\binom{5}{3} = 10$).
- (C) $\frac{1}{2}$ ignores the binomial weighting altogether.
- (D) $\frac{5}{32}$ uses a coefficient of $5$ instead of $\binom{5}{3} = 10$.

**Final Answer:** $P(X = 3) = \frac{5}{16} \Rightarrow \boxed{\text{A}}$

**Answer: (A)** **Go Back to Q20**

## Answer Key

| Q | Ans | Q | Ans | Q | Ans | Q | Ans | Q | Ans |
|---|---|---|---|---|---|---|---|---|---|
| 1 | B | 2 | B | 3 | D | 4 | A | 5 | C |
| 6 | D | 7 | B | 8 | A | 9 | C | 10 | B |
| 11 | A | 12 | D | 13 | C | 14 | B | 15 | D |
| 16 | A | 17 | C | 18 | B | 19 | D | 20 | A |