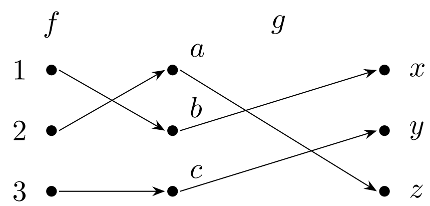
NEST Mathematics Sample Paper – 5

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. Let $f : \{1, 2, 3\} \to \{a, b, c\}$ and $g : \{a, b, c\} \to \{x, y, z\}$ be defined by the mapping diagram below. The value of $(g \circ f)(2)$ is



(A) z

(B) x

(C) y

(D) a

Q2. The number of principal solutions of the equation $2\cos^2 x = 1$ in the interval $[0, 2\pi)$ is

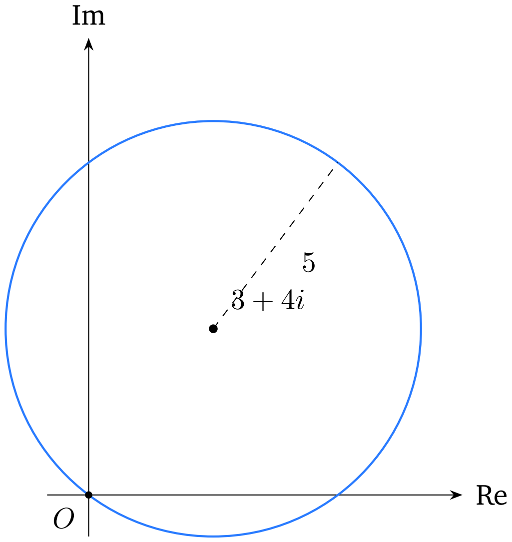
(A) 2

(B) 3

(C) 4

(D) 6

Q3. In the Argand plane, the set of all complex numbers z satisfying $|z-(3+4i)| = 5$ is



(A) a circle of radius 5 centred at $(3,4)$, passing through the origin

(B) a circle of radius 3 centred at the origin

(C) a straight line through $(3,4)$

(D) a circle of radius 5 centred at the origin

Q4. The number of distinct arrangements of all the letters of the word BALLOON is

(A) 5040

(B) 2520

(C) 720

(D) 1260

Q5. The coefficient of x^4 in the binomial expansion of $\left(x+\dfrac{2}{x}\right)^8$ is

(A) 56

(B) 448

(C) 112

(D) 224

Q6. The sum of the first 6 terms of the geometric progression $3,\ 6,\ 12,\ 24,\ \ldots$ is

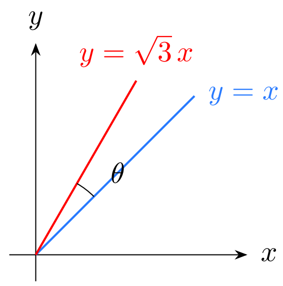
(A) 93

(B) 189

(C) 192

(D) 96

Q7. The acute angle between the two straight lines $y = x$ and $y = \sqrt{3}\,x$ shown below is



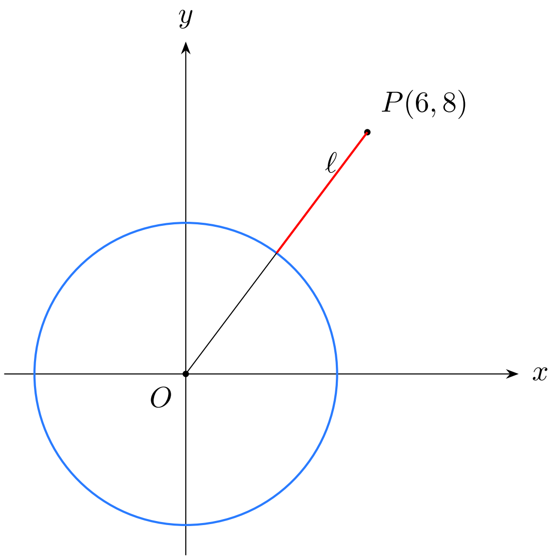
(A) $15°$

(B) $30°$

(C) $45°$

(D) $60°$

Q8. The length of the tangent drawn from the external point $P(6, 8)$ to the circle $x^2 + y^2 = 25$ is



(A) 5

(B) $5\sqrt{3}$

(C) $\sqrt{125}$

(D) 10

Q9. If $f(x) = \dfrac{x^2+1}{x+1}$, then the value of $f'(1)$ is

(A) 0

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

(C) 1

(D) 2

Q10. Two cricketers P and Q have batting scores with means and standard deviations: P has mean 50, standard deviation 5; Q has mean 40, standard deviation 5. The more consistent batsman (smaller coefficient of variation) is

(A) Q, with CV $= 10\%$

(B) both equally consistent

(C) P, with CV $= 10\%$

(D) Q, with CV $= 12.5\%$

Q11. The value of $2\tan^{-1}\left(\frac{1}{3}\right)$ expressed as a single inverse-tangent is

(A) $\tan^{-1}\left(\frac{3}{4}\right)$

(B) $\tan^{-1}\left(\frac{2}{3}\right)$

(C) $\tan^{-1}\left(\frac{1}{9}\right)$

(D) $\tan^{-1}\left(\frac{4}{3}\right)$

Q12. If $A = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$, then the matrix A^2 is

(A) $\begin{bmatrix} 4 & 1 \\ 0 & 9 \end{bmatrix}$

(B) $\begin{bmatrix} 4 & 2 \\ 0 & 6 \end{bmatrix}$

(C) $\begin{bmatrix} 4 & 3 \\ 0 & 9 \end{bmatrix}$

(D) $\begin{bmatrix} 4 & 5 \\ 0 & 9 \end{bmatrix}$

Q13. For a 3×3 matrix A with $\det(A) = 4$, the value of $\det(\operatorname{adj} A)$ is

(A) 4

(B) 16

(C) 64

(D) 12

Q14. If $y = \sin^{-1}(\sqrt{x})$ for $0 < x < 1$, then $\frac{dy}{dx}$ equals

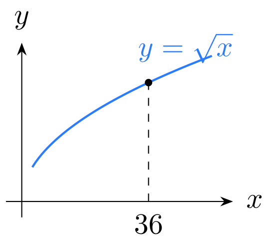
(A) $\frac{1}{\sqrt{1-x}}$

(B) $\dfrac{1}{2\sqrt{1-x}}$

(C) $\dfrac{1}{2\sqrt{x(1-x)}}$

(D) $\dfrac{1}{\sqrt{x(1-x)}}$

Q15. Using differentials, the approximate value of $\sqrt{36.6}$ (given $\sqrt{36} = 6$) is



(A) 6.05

(B) 6.5

(C) 6.6

(D) 6.005

Q16. Using the property $\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$, the value of $\int_0^{\pi/2} \dfrac{\sin x}{\sin x + \cos x}\,dx$ is

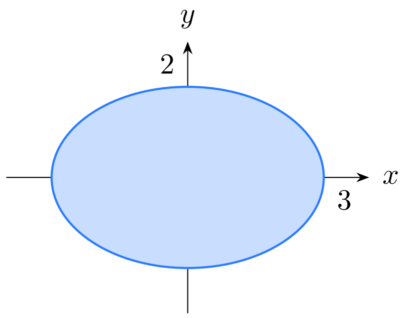
(A) $\dfrac{\pi}{2}$

(B) 1

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

(D) $\dfrac{\pi}{4}$

Q17. The area enclosed by the ellipse $\dfrac{x^2}{9} + \dfrac{y^2}{4} = 1$ is



(A) 36π

(B) 12π

(C) 6π

(D) 5π

Q18. The differential equation whose general solution is $y = Cx$ (where C is an arbitrary constant) is

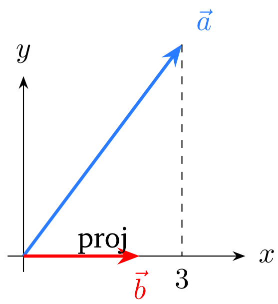
(A) $x\dfrac{dy}{dx} + y = 0$

(B) $x\dfrac{dy}{dx} - y = 0$

(C) $\dfrac{dy}{dx} = x$

(D) $\dfrac{dy}{dx} + y = 0$

Q19. The scalar projection of $\vec{a} = 3\hat{\imath} + 4\hat{\jmath}$ onto $\vec{b} = \hat{\imath}$ is



(A) 3

(B) 4

(C) 5

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

Q20. A fair coin is tossed 4 times. If X denotes the number of heads, then the variance of X is

(A) 2

(B) 4

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

(D) 1

Detailed Solutions

Q1.

Solution

Concept — Composition of functions: $(g \circ f)(x) = g(f(x))$; first apply f, then feed the output into g.

Step 1 — Apply f at 2: From the diagram, $f(2) = a$ (the arrow from 2 lands on a).

Step 2 — Apply g at a: The arrow from a lands on z, so $g(a) = z$. Hence $(g \circ f)(2) = g(a) = z$.

Why other options are wrong:

- (B) x is $g(c)$, not $g(f(2))$.
- (C) y is $g(b) = g(f(1))$, the image of 1, not 2.
- (D) a is only the intermediate value $f(2)$, not the final composition.

Final Answer: $(g \circ f)(2) = z \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — Principal solutions: Solutions of a trigonometric equation lying in $[0, 2\pi)$ are called principal solutions; count all of them in one full turn.

Step 1 — Reduce the equation: $2\cos^2 x = 1 \Rightarrow \cos^2 x = \frac{1}{2} \Rightarrow \cos x = \pm\frac{1}{\sqrt{2}}$.

Step 2 — List solutions in $[0, 2\pi)$: $\cos x = \frac{1}{\sqrt{2}}$ gives $x = \frac{\pi}{4}, \frac{7\pi}{4}$; $\cos x = -\frac{1}{\sqrt{2}}$ gives $x = \frac{3\pi}{4}, \frac{5\pi}{4}$.

Step 3 — Count: Four distinct values, so the number of principal solutions is 4.

Why other options are wrong:

- (A) 2 keeps only the positive root $\cos x = +\frac{1}{\sqrt{2}}$.
- (B) 3 miscounts one branch.
- (D) 6 over-counts by including values outside $[0, 2\pi)$.

Final Answer: 4 principal solutions $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — Locus from $|z - z_0| = r$: The set of points whose distance from a fixed point z_0 is a constant r is a circle of radius r centred at z_0.

Step 1 — Identify centre and radius: Here $z_0 = 3 + 4i$, i.e. the centre $(3, 4)$, and $r = 5$.

Step 2 — Check the origin: Distance of $(3, 4)$ from O is $\sqrt{3^2 + 4^2} = 5 = r$, so the circle passes through the origin.

Why other options are wrong:

- (B) radius 3 centred at origin misreads both centre and radius.
- (C) the equation is a distance condition, giving a circle, not a line.
- (D) the centre is $(3, 4)$, not the origin.

Final Answer: circle of radius 5 at $(3, 4)$ through the origin $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — Permutations with repetition: The number of distinct arrangements of n letters where a letter repeats p times, another q times, etc., is $\dfrac{n!}{p!\,q!\,\cdots}$.

Step 1 — Count letters: BALLOON has 7 letters: B, A, L, L, O, O, N. Here L repeats twice and O repeats twice.

Step 2 — Apply the formula:

$$\frac{7!}{2!\,2!} = \frac{5040}{4} = 1260.$$

Why other options are wrong:

- (A) $5040 = 7!$ ignores both repetitions.
- (B) $2520 = 7!/2!$ divides by only one repeated pair.
- (C) $720 = 6!$ uses the wrong number of letters.

Final Answer: 1260 arrangements $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — General term: For $\left(x+\frac{2}{x}\right)^8$, the general term is $T_{r+1} = \binom{8}{r}x^{8-r}\left(\frac{2}{x}\right)^r = \binom{8}{r}2^r\,x^{8-2r}$.

Step 1 — Match the power: Set $8-2r=4 \Rightarrow r=2$.

Step 2 — Compute the coefficient: $\binom{8}{2}2^2 = 28\times 4 = 112$.

Why other options are wrong:

- (A) $56=\binom{8}{3}$, the wrong term, also missing the 2^r factor.
- (B) $448=\binom{8}{2}\cdot 2^4$ uses the wrong power of 2.
- (D) $224=\binom{8}{2}\cdot 2^3$ takes $r=3$ for the 2-factor.

Final Answer: coefficient of x^4 is $112 \Rightarrow \boxed{C}$

Answer: (C) Go Back to Q5

Q6.

Solution

Concept — Sum of a GP: For a GP with first term a and ratio $r\neq 1$, $S_n = a\dfrac{r^n-1}{r-1}$.

Step 1 — Identify a and r: $a=3$, $r=\dfrac{6}{3}=2$, $n=6$.

Step 2 — Compute:

$$S_6 = 3\cdot\frac{2^6-1}{2-1} = 3\cdot\frac{64-1}{1} = 3\times 63 = 189.$$

Why other options are wrong:

- (A) 93 sums only the first 5 terms.
- (C) $192=3\cdot 2^6$ is ar^6, not the sum.
- (D) 96 is the 6th term $ar^5=3\cdot 32$, not the sum.

Final Answer: $S_6=189 \Rightarrow \boxed{B}$

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Angle between two lines: If the lines have slopes m_1, m_2, then $\tan\theta = \left|\dfrac{m_1 - m_2}{1 + m_1 m_2}\right|$.

Step 1 — Slopes: $m_1 = 1$ (line $y = x$), $m_2 = \sqrt{3}$ (line $y = \sqrt{3}x$).

Step 2 — Apply the formula:

$$\tan\theta = \left|\frac{1-\sqrt{3}}{1+\sqrt{3}}\right| = \frac{\sqrt{3}-1}{\sqrt{3}+1} = \frac{(\sqrt{3}-1)^2}{2} = \frac{4-2\sqrt{3}}{2} = 2-\sqrt{3}.$$

Since $\tan 15^\circ = 2 - \sqrt{3}$, we get $\theta = 15^\circ$. (Directly: the lines make 45° and 60° with the x-axis, difference 15°.)

Why other options are wrong:

- (B) 30° would need slopes such as $\tan\theta = \frac{1}{\sqrt{3}}$.
- (C) 45° is the inclination of $y = x$, not the angle between the lines.
- (D) 60° is the inclination of $y = \sqrt{3}x$, not the angle between them.

Final Answer: $\theta = 15^\circ \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q7

Q8.

Solution

Concept — Length of tangent: The length of the tangent from an external point (x_1, y_1) to the circle $x^2 + y^2 = a^2$ is $\ell = \sqrt{x_1^2 + y_1^2 - a^2}$.

Step 1 — Substitute: Point $P(6, 8)$, circle $x^2 + y^2 = 25$ so $a^2 = 25$:

$$\ell = \sqrt{6^2 + 8^2 - 25} = \sqrt{36 + 64 - 25} = \sqrt{75}.$$

Step 2 — Cross-check geometry: $OP = \sqrt{36 + 64} = 10$, radius $= 5$, so $\ell = \sqrt{OP^2 - r^2} = \sqrt{100 - 25} = \sqrt{75} = 5\sqrt{3}$.

Why other options are wrong:

- (A) 5 is the radius, not the tangent length.
- (C) $\sqrt{125}$ forgets to subtract a^2 correctly (uses $+25$ region).
- (D) the value 10 is OP (the distance to the centre), not the tangent length.

Final Answer: $\ell = \sqrt{75} = 5\sqrt{3} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q8

Q9.

Solution

Concept — Quotient rule: $\frac{d}{dx}\frac{u}{v} = \frac{u'v - uv'}{v^2}$.

Step 1 — Identify and differentiate: $u = x^2 + 1,\ u' = 2x;\ v = x + 1,\ v' = 1.$

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

Step 2 — Evaluate at $x = 1$:

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

Why other options are wrong:

- (A) 0 drops the $-uv'$ term in the numerator.
- (C) 1 forgets to square the denominator.
- (D) 2 uses only the numerator $2x$ at $x = 1$ without the quotient rule.

Final Answer: $f'(1) = \frac{1}{2} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q9

Q10.

Solution

Concept — Coefficient of variation: $\text{CV} = \frac{\sigma}{\bar{x}} \times 100\%$; a smaller CV means more consistency.

Step 1 — CV of P: $\text{CV}_P = \frac{5}{50} \times 100 = 10\%$.

Step 2 — CV of Q: $\text{CV}_Q = \frac{5}{40} \times 100 = 12.5\%$.

Step 3 — Compare: $10\% < 12.5\%$, so P is the more consistent batsman.

Why other options are wrong:

- (A) names Q as more consistent and misstates its CV.

- (B) the CVs differ, so they are not equally consistent.
- (D) correctly computes $\text{CV}_Q = 12.5\%$ but wrongly calls Q more consistent.

Final Answer: P is more consistent, $\text{CV}_P = 10\% \Rightarrow \boxed{\text{C}}$

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

Q11.

Solution

Concept — Double-angle identity: For $-1 < x < 1$, $2\tan^{-1} x = \tan^{-1}\left(\dfrac{2x}{1-x^2}\right)$.

Step 1 — Substitute $x = \dfrac{1}{3}$:

$$\frac{2x}{1-x^2} = \frac{2\cdot\frac{1}{3}}{1-\frac{1}{9}} = \frac{\frac{2}{3}}{\frac{8}{9}} = \frac{2}{3}\cdot\frac{9}{8} = \frac{3}{4}.$$

Step 2 — Conclude: $2\tan^{-1}\left(\frac{1}{3}\right) = \tan^{-1}\left(\frac{3}{4}\right)$ (valid since $\frac{1}{3} < 1$).

Why other options are wrong:

- (B) $\frac{2}{3}$ uses only the numerator $2x$ and forgets to divide by $1-x^2$.
- (C) $\frac{1}{9}$ is x^2, not the double-angle value.
- (D) $\frac{4}{3}$ inverts the correct ratio.

Final Answer: $2\tan^{-1}\left(\frac{1}{3}\right) = \tan^{-1}\left(\frac{3}{4}\right) \Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q11**

Q12.

Solution

Concept — Matrix multiplication: $A^2 = A\cdot A$; each entry of the product is a row-times-column dot product.

Step 1 — Multiply:

$$A^2 = \begin{bmatrix}2 & 1\\0 & 3\end{bmatrix}\begin{bmatrix}2 & 1\\0 & 3\end{bmatrix} = \begin{bmatrix}2\cdot2+1\cdot0 & 2\cdot1+1\cdot3\\0\cdot2+3\cdot0 & 0\cdot1+3\cdot3\end{bmatrix} = \begin{bmatrix}4 & 5\\0 & 9\end{bmatrix}.$$

Why other options are wrong:

- (A) squares each entry individually, which is not matrix multiplication.
- (B) mishandles the top-right and bottom-right entries.
- (C) gives top-right 3 instead of $2 \cdot 1 + 1 \cdot 3 = 5$.

Final Answer: $A^2 = \begin{bmatrix} 4 & 5 \\ 0 & 9 \end{bmatrix} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Adjugate determinant: For an $n \times n$ matrix, $\det(\operatorname{adj} A) = \big(\det A\big)^{n-1}$.

Step 1 — Set $n = 3$: $\det(\operatorname{adj} A) = (\det A)^{3-1} = (\det A)^2$.

Step 2 — Substitute $\det A = 4$: $(\det A)^2 = 4^2 = 16$.

Why other options are wrong:

- (A) 4 uses exponent $n - 2$ (i.e. takes $\det A$ itself).
- (C) $64 = 4^3$ uses exponent n instead of $n - 1$.
- (D) $12 = 3 \times 4$ confuses the order n with a multiplier.

Final Answer: $\det(\operatorname{adj} A) = 16 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q13

Q14.

Solution

Concept — Chain rule with $\sin^{-1}$: $\dfrac{d}{dx} \sin^{-1} u = \dfrac{1}{\sqrt{1-u^2}} \cdot \dfrac{du}{dx}$.

Step 1 — Set $u = \sqrt{x}$: Then $u^2 = x$ and $\dfrac{du}{dx} = \dfrac{1}{2\sqrt{x}}$.

Step 2 — Apply the chain rule:

$$\frac{dy}{dx} = \frac{1}{\sqrt{1-x}} \cdot \frac{1}{2\sqrt{x}} = \frac{1}{2\sqrt{x}\,\sqrt{1-x}} = \frac{1}{2\sqrt{x(1-x)}}.$$

Why other options are wrong:

- (A) $\dfrac{1}{\sqrt{1-x}}$ omits the inner derivative $\dfrac{1}{2\sqrt{x}}$.

- (B) $\dfrac{1}{2\sqrt{1-x}}$ keeps the factor $\frac{1}{2}$ but still drops the $\dfrac{1}{\sqrt{x}}$ piece.
- (D) $\dfrac{1}{\sqrt{x(1-x)}}$ drops the factor $\frac{1}{2}$.

Final Answer: $\dfrac{dy}{dx} = \dfrac{1}{2\sqrt{x(1-x)}} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q14

Q15.

Solution

Concept — Linear approximation: For small Δx, $f(x + \Delta x) \approx f(x) + f'(x)\,\Delta x$, where $dy = f'(x)\,\Delta x$.

Step 1 — Set up: Let $f(x) = \sqrt{x}$, $x = 36$, $\Delta x = 0.6$. Then $f'(x) = \dfrac{1}{2\sqrt{x}} = \dfrac{1}{12}$.

Step 2 — Compute the increment: $dy = \dfrac{1}{12} \times 0.6 = 0.05$.

Step 3 — Approximate: $\sqrt{36.6} \approx 6 + 0.05 = 6.05$.

Why other options are wrong:

- (B) 6.5 adds 0.5 to 6 instead of the differential 0.05.
- (C) 6.6 adds the whole $\Delta x = 0.6$ directly to 6.
- (D) 6.005 uses $\Delta x = 0.06$ by a decimal slip.

Final Answer: $\sqrt{36.6} \approx 6.05 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q15

Q16.

Solution

Concept — King's property: $\displaystyle\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$; adding the two forms often collapses the integrand.

Step 1 — Write I twice: Let $I = \displaystyle\int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x}\,dx$. Replacing $x \to \dfrac{\pi}{2} - x$ swaps $\sin$ and $\cos$:

$$I = \int_0^{\pi/2} \frac{\cos x}{\cos x + \sin x}\,dx.$$

Step 2 — Add:

$$2I = \int_0^{\pi/2} \frac{\sin x + \cos x}{\sin x + \cos x}\, dx = \int_0^{\pi/2} 1\, dx = \frac{\pi}{2}.$$

Hence $I = \frac{\pi}{4}$.

Why other options are wrong:

- (A) $\frac{\pi}{2}$ is $2I$, not I.
- (B) 1 ignores the limits and the factor of 2.
- (C) $\frac{\pi}{3}$ does not arise from this symmetric integrand.

Final Answer: $I = \frac{\pi}{4} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Area of an ellipse: The ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ encloses area πab.

Step 1 — Read a and b: $a^2 = 9 \Rightarrow a = 3$; $b^2 = 4 \Rightarrow b = 2$.

Step 2 — Compute: Area $= \pi ab = \pi(3)(2) = 6\pi$.

Why other options are wrong:

- (A) $36\pi = \pi a^2 b^2$ multiplies the squares instead of a, b.
- (B) $12\pi = \pi(2ab)$ doubles the area (full vs. semi confusion).
- (D) 5π comes from $\pi(a + b)$, which is not the area.

Final Answer: Area $= 6\pi \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q17

Q18.

Solution

Concept — Forming a differential equation: Differentiate the general solution and eliminate the arbitrary constant C.

Step 1 — Differentiate: From $y = Cx$, $\frac{dy}{dx} = C$.

Step 2 — Eliminate C: Since $C = \frac{y}{x}$, we get $\frac{dy}{dx} = \frac{y}{x}$, i.e.

$$x\frac{dy}{dx} - y = 0.$$

Why other options are wrong:

- (A) $x\frac{dy}{dx} + y = 0$ has general solution $xy = \text{const}$, not $y = Cx$.
- (C) $\frac{dy}{dx} = x$ integrates to $y = \frac{x^2}{2} + C$, a parabola family.
- (D) $\frac{dy}{dx} + y = 0$ gives $y = Ce^{-x}$, an exponential family.

Final Answer: $x\frac{dy}{dx} - y = 0 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — Scalar projection: The scalar projection of $\vec{a}$ onto $\vec{b}$ is $\frac{\vec{a}\cdot\vec{b}}{|\vec{b}|}$.

Step 1 — Dot product: $\vec{a}\cdot\vec{b} = (3)(1) + (4)(0) = 3$.

Step 2 — Magnitude of $\vec{b}$: $|\vec{b}| = \sqrt{1^2 + 0^2} = 1$.

Step 3 — Projection: $\frac{\vec{a}\cdot\vec{b}}{|\vec{b}|} = \frac{3}{1} = 3$ (this is the x-component of $\vec{a}$, as the dashed drop to the axis shows).

Why other options are wrong:

- (B) 4 is the projection onto $\hat{\jmath}$, not $\hat{\imath}$.
- (C) $5 = |\vec{a}|$, the full magnitude, not its projection.
- (D) $\frac{3}{5}$ divides by $|\vec{a}|$ instead of $|\vec{b}|$ (that is $\cos\theta$).

Final Answer: projection $= 3 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q19

Q20.

Solution

Concept — Binomial distribution: For n independent trials with success probability p, the variance of the number of successes is $\text{Var}(X) = np(1-p)$.

Step 1 — Identify parameters: A fair coin gives $p = \dfrac{1}{2}$, with $n = 4$ tosses, so $X \sim B(4, \frac{1}{2})$.

Step 2 — Compute the variance:

$$\text{Var}(X) = np(1-p) = 4 \cdot \frac{1}{2} \cdot \frac{1}{2} = 1.$$

Why other options are wrong:

- (A) $2 = np$ is the *mean*, not the variance.
- (B) 4 forgets the factor $p(1-p) = \frac{1}{4}$.
- (C) $\dfrac{1}{2}$ uses $p(1-p)$ for one trial only ($n = 2$).

Final Answer: $\text{Var}(X) = 1 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Answer Key

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