NEST Mathematics Sample Paper – 2

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 domain of the real-valued function $f(x) = \dfrac{1}{\sqrt{x-2}} + \log_{10}(5-x)$ is

(A) $[2, 5)$

(B) $(2, 5)$

(C) $(2, 5]$

(D) $[2, 5]$

Q2. The maximum value of the expression $3\sin x + 4\cos x + 10$ as x varies over all real numbers is

(A) 13

(B) 17

(C) 15

(D) 25

Q3. If $\omega\,(\neq 1)$ is a cube root of unity, then the value of $(1+\omega-\omega^2)^3+(1-\omega+\omega^2)^3$ is

(A) -16

(B) 16

(C) 0

(D) 8

Q4. A committee of 4 members is to be formed from 6 men and 4 women so that the committee contains exactly 2 men and 2 women. The number of ways of forming such a committee is

(A) 120

(B) 60

(C) 45

(D) 90

Q5. The coefficient of x^5 in the binomial expansion of $\left(x^2+\dfrac{1}{x}\right)^7$ is

(A) 7

(B) 21

(C) 35

(D) 1

Q6. The sum to infinity of the geometric progression $9+6+4+\dfrac{8}{3}+\cdots$ is

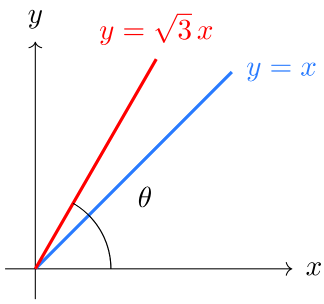
(A) 27

(B) 18

(C) 15

(D) $\dfrac{27}{2}$

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



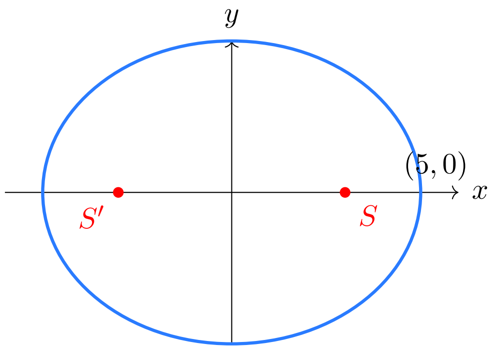
(A) $30°$

(B) $45°$

(C) $60°$

(D) $15°$

Q8. For the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ shown below, the eccentricity and the foci are



(A) $e = \frac{4}{5}$, $(\pm 4, 0)$

(B) $e = \frac{3}{4}$, $(\pm 3, 0)$

(C) $e = \frac{3}{5}$, $(\pm 3, 0)$

(D) $e = \frac{3}{5}$, $(0, \pm 3)$

Q9. Using the first-principles definition $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$, the derivative of $f(x) = x^2 + 3x$ at $x = 2$ is

(A) 7

(B) 4

(C) 10

(D) 5

Q10. The mean deviation about the mean for the data $4,\ 7,\ 8,\ 9,\ 12$ is

(A) 1.6

(B) 2.0

(C) 2.4

(D) 8.0

Q11. Using the identity $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$, the value of $\sin^{-1}\frac{1}{2} + \cos^{-1}\frac{1}{2} + \tan^{-1} 1$ is

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

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

(C) π

(D) $\frac{3\pi}{4}$

Q12. If $A = \begin{bmatrix} 0 & 2 & -3 \\ -2 & 0 & 5 \\ 3 & -5 & 0 \end{bmatrix}$, then the matrix A is

(A) symmetric

(B) an identity matrix

(C) skew-symmetric

(D) a scalar matrix

Q13. The area of the triangle whose vertices are $(1,1)$, $(4,1)$ and $(4,5)$, evaluated using a determinant, is

(A) 6 square units

(B) 12 square units

(C) 3 square units

(D) 9 square units

Q14. The function $f(x) = |x - 3|$ is

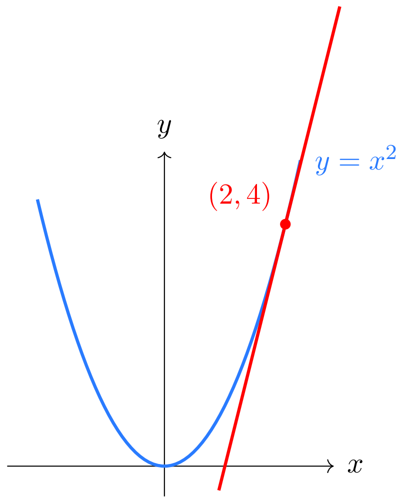
(A) differentiable everywhere on $\mathbb{R}$

(B) continuous everywhere but not differentiable at $x = 3$

(C) discontinuous at $x = 3$

(D) differentiable only at $x = 3$

Q15. The slope of the tangent to the curve $y = x^2$ at the point $(2, 4)$, shown below, is



(A) 2

(B) 8

(C) 4

(D) $\frac{1}{4}$

Q16. The value of the definite integral $\int_0^1 (3x^2 + 2x)\, dx$ is

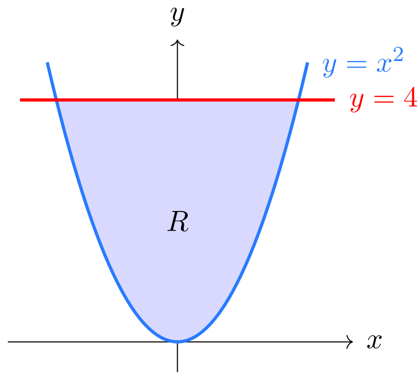
(A) 1

(B) 3

(C) $\frac{5}{2}$

(D) 2

Q17. The area of the region bounded by the curve $y = x^2$ and the line $y = 4$, shown shaded below, is



(A) $\frac{32}{3}$ square units

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

(C) $\frac{8}{3}$ square units

(D) 16 square units

Q18. The general solution of the variable-separable differential equation $\frac{dy}{dx} = \frac{x}{y}$ is (with C an arbitrary constant)

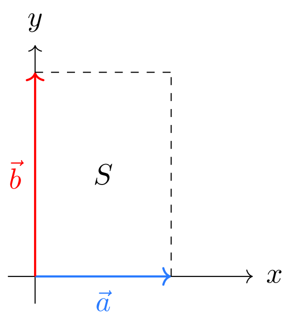
(A) $y^2 - x^2 = C$

(B) $x^2 - y^2 = C$

(C) $y^2 + x^2 = C$

(D) $y = Cx$

Q19. The area of the parallelogram whose adjacent sides are the vectors $\vec{a} = 2\hat{\imath} + 0\hat{\jmath}$ and $\vec{b} = 0\hat{\imath} + 3\hat{\jmath}$, shown below, is



(A) 5 square units

(B) $\sqrt{13}$ square units

(C) 6 square units

(D) 3 square units

Q20. Two factories X and Y produce identical bulbs. Factory X makes 60% of the bulbs and factory Y makes 40%. Of X's bulbs 2% are defective, and of Y's bulbs 3% are defective. A bulb chosen at random is found to be defective. The probability that it was made by factory Y is

(A) $\frac{2}{5}$

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

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

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

Detailed Solutions

Q1.

Solution

Concept — Domain of a function: The domain is the set of x for which every part is defined: a $\sqrt{\ }$ in a denominator needs a strictly positive radicand, and a $\log$ needs a strictly positive argument.

Step 1 — Square-root term: $\frac{1}{\sqrt{x-2}}$ requires $x - 2 > 0$, i.e. $x > 2$ (equality excluded because it sits in the denominator).

Step 2 — Logarithm term: $\log_{10}(5 - x)$ requires $5 - x > 0$, i.e. $x < 5$.

Step 3 — Intersection: $x > 2$ and $x < 5$ give $(2, 5)$.

Why other options are wrong:

- (A) $[2, 5)$ wrongly includes $x = 2$, where the denominator is 0.
- (C) $(2, 5]$ wrongly includes $x = 5$, where the log argument is 0.
- (D) $[2, 5]$ includes both forbidden endpoints.

Final Answer: Domain $= (2, 5) \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Range of $a \sin x + b \cos x$: The expression $a \sin x + b \cos x$ lies between $-\sqrt{a^2 + b^2}$ and $+\sqrt{a^2 + b^2}$.

Step 1 — Amplitude: Here $a = 3,\ b = 4$, so $\sqrt{a^2 + b^2} = \sqrt{9 + 16} = \sqrt{25} = 5$. Thus $3 \sin x + 4 \cos x$ has maximum 5.

Step 2 — Add the constant: The maximum of $3 \sin x + 4 \cos x + 10$ is $5 + 10 = 15$.

Why other options are wrong:

- (A) 13 uses amplitude 3 only.
- (B) 17 adds $3 + 4$ $(= 7)$ instead of $\sqrt{a^2 + b^2}$.
- (D) 25 uses $a^2 + b^2$ without the square root.

Final Answer: Maximum $= 15 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — Cube roots of unity: If $\omega \neq 1$ is a cube root of unity, then $1+\omega+\omega^2 = 0$ and $\omega^3 = 1$.

Step 1 — Simplify each bracket: Since $1+\omega+\omega^2 = 0$, we have $1+\omega = -\omega^2$ and $1+\omega^2 = -\omega$. Hence

$$1+\omega-\omega^2 = (1+\omega)-\omega^2 = -\omega^2-\omega^2 = -2\omega^2,$$

$$1-\omega+\omega^2 = (1+\omega^2)-\omega = -\omega-\omega = -2\omega.$$

Step 2 — Cube and add: $(-2\omega^2)^3 = -8\,\omega^6 = -8(\omega^3)^2 = -8$ and $(-2\omega)^3 = -8\,\omega^3 = -8$. Their sum is $-8+(-8) = -16$.

Why other options are wrong:

- (B) 16 drops the overall negative sign from cubing -2.
- (C) 0 would need the two cubes to cancel, but both equal -8.
- (D) 8 uses only one bracket or a sign slip.

Final Answer: The value is $-16 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — Combinations for selection: The number of ways to choose r items from n (order irrelevant) is $\binom{n}{r}$. Independent choices multiply.

Step 1 — Choose the men: 2 men from 6: $\binom{6}{2} = \dfrac{6\cdot 5}{2} = 15$.

Step 2 — Choose the women: 2 women from 4: $\binom{4}{2} = \dfrac{4\cdot 3}{2} = 6$.

Step 3 — Multiply: Total $= 15 \times 6 = 90$.

Why other options are wrong:

- (A) 120 counts $\binom{10}{4}/\ldots$ or treats order as relevant.
- (B) 60 uses $\binom{6}{2}\cdot\binom{4}{1}$ wrongly.
- (C) 45 uses only $\binom{10}{2}$.

Final Answer: 90 committees $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — General term of a binomial expansion: For $\left(x^2 + \frac{1}{x}\right)^7$, the general term is $T_{r+1} = \binom{7}{r}(x^2)^{7-r}(x^{-1})^r = \binom{7}{r}x^{14-3r}$.

Step 1 — Match the power: Set $14 - 3r = 5 \Rightarrow 3r = 9 \Rightarrow r = 3$.

Step 2 — Coefficient: $\binom{7}{3} = \frac{7 \cdot 6 \cdot 5}{3 \cdot 2 \cdot 1} = 35$.

Why other options are wrong:

- (A) 7 is $\binom{7}{1}$ (wrong r).
- (B) 21 is $\binom{7}{2}$ (would match x^8).
- (D) 1 is $\binom{7}{0}$ or $\binom{7}{7}$.

Final Answer: Coefficient of x^5 is 35 $\Rightarrow$ C

Answer: (C) Go Back to Q5

Q6.

Solution

Concept — Sum of an infinite GP: If $|r| < 1$, then $a + ar + ar^2 + \cdots = \frac{a}{1-r}$.

Step 1 — Identify a and r: First term $a = 9$; common ratio $r = \frac{6}{9} = \frac{2}{3}$ (check: $4/6 = 2/3$). Since $|r| < 1$ the sum converges.

Step 2 — Apply the formula: $S_\infty = \frac{9}{1 - \frac{2}{3}} = \frac{9}{\frac{1}{3}} = 27$.

Why other options are wrong:

- (B) 18 uses $\frac{a}{1-r}$ with $r = \frac{1}{2}$.
- (C) 15 comes from a wrong ratio.
- (D) $\frac{27}{2}$ halves the correct sum.

Final Answer: $S_\infty = 27 \Rightarrow$ A

Answer: (A) Go Back to Q6

Q7.

Solution

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

Step 1 — Slopes: $y = x$ has $m_1 = 1$; $y = \sqrt{3}x$ has $m_2 = \sqrt{3}$.

Step 2 — Apply the formula:

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

Rationalising, $\dfrac{(1-\sqrt{3})^2}{(1+\sqrt{3})(1-\sqrt{3})} = \dfrac{1-2\sqrt{3}+3}{1-3} = \dfrac{4-2\sqrt{3}}{-2} = \sqrt{3}-2$, whose magnitude is $2-\sqrt{3}$.

Step 3 — Identify the angle: $\tan 15^\circ = 2-\sqrt{3}$, so $\theta = 15^\circ$. (Directly: the lines make 45° and 60° with the x-axis, difference 15°.)

Why other options are wrong:

- (A) 30° and (B) 45° misread the inclinations.
- (C) 60° is the inclination of the second line, not the angle between them.

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

Answer: (D) Go Back to Q7

Q8.

Solution

Concept — Ellipse parameters: For $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ with $a > b$, $b^2 = a^2(1-e^2)$, foci at $(\pm ae, 0)$.

Step 1 — Read a, b: $a^2 = 25 \Rightarrow a = 5$; $b^2 = 16 \Rightarrow b = 4$. Since $a > b$, the major axis is along the x-axis.

Step 2 — Eccentricity: $e = \sqrt{1-\dfrac{b^2}{a^2}} = \sqrt{1-\dfrac{16}{25}} = \sqrt{\dfrac{9}{25}} = \dfrac{3}{5}$.

Step 3 — Foci: $ae = 5 \cdot \dfrac{3}{5} = 3$, so foci at $(\pm 3, 0)$.

Why other options are wrong:

- (A) $e = \frac{4}{5}$ uses $\sqrt{1-b/a}$ instead of $\sqrt{1-b^2/a^2}$.

- (B) $e = \frac{3}{4}$ is computed from a wrong relation.
- (D) puts the foci on the y-axis, but the major axis is along x.

Final Answer: $e = \dfrac{3}{5}$, foci $(\pm 3, 0) \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q8

Q9.

Solution

Concept — Derivative from first principles: $f'(x) = \lim_{h\to 0} \dfrac{f(x+h) - f(x)}{h}$.

Step 1 — Form the difference quotient at $x = 2$: With $f(x) = x^2 + 3x$,

$$f(2+h) = (2+h)^2 + 3(2+h) = 4 + 4h + h^2 + 6 + 3h = 10 + 7h + h^2, \quad f(2) = 10.$$

Step 2 — Simplify and take the limit:

$$\frac{f(2+h) - f(2)}{h} = \frac{7h + h^2}{h} = 7 + h \xrightarrow{h\to 0} 7.$$

Step 3 — Check by power rule: $f'(x) = 2x + 3$, so $f'(2) = 4 + 3 = 7$.

Why other options are wrong:

- (B) 4 uses only the $2x$ term.
- (C) 10 is $f(2)$, not $f'(2)$.
- (D) 5 comes from $2x + 1$ (wrong derivative of $3x$).

Final Answer: $f'(2) = 7 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Mean deviation about the mean: MD $= \dfrac{1}{n} \sum |x_i - \bar{x}|$, where $\bar{x}$ is the mean.

Step 1 — Mean: $\bar{x} = \dfrac{4 + 7 + 8 + 9 + 12}{5} = \dfrac{40}{5} = 8$.

Step 2 — Absolute deviations: $|4 - 8| = 4,\ |7 - 8| = 1,\ |8 - 8| = 0,\ |9 - 8| = 1,\ |12 - 8| = 4$; sum $= 10$.

Step 3 — Mean deviation: $\text{MD} = \frac{10}{5} = 2.0$.

Why other options are wrong:

- (A) 1.6 divides the deviation sum by a wrong count or uses median wrongly.
- (C) 2.4 comes from an arithmetic slip in the deviations.
- (D) 8.0 is the mean itself, not the mean deviation.

Final Answer: $\text{MD} = 2.0 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Inverse-trig identity: For all $x \in [-1, 1]$, $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$.

Step 1 — Combine the first two terms: With $x = \frac{1}{2}$, $\sin^{-1}\frac{1}{2} + \cos^{-1}\frac{1}{2} = \frac{\pi}{2}$ directly from the identity.

Step 2 — Add the third term: $\tan^{-1} 1 = \frac{\pi}{4}$. Hence the total is $\frac{\pi}{2} + \frac{\pi}{4} = \frac{3\pi}{4}$.

Why other options are wrong:

- (A) $\frac{\pi}{2}$ forgets the $\tan^{-1} 1$ term.
- (B) $\frac{\pi}{4}$ keeps only $\tan^{-1} 1$.
- (C) π uses $\tan^{-1} 1 = \frac{\pi}{2}$ by mistake.

Final Answer: The value is $\frac{3\pi}{4} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q11

Q12.

Solution

Concept — Skew-symmetric matrix: A square matrix A is skew-symmetric if $A^T = -A$; equivalently $a_{ji} = -a_{ij}$ and all diagonal entries are 0.

Step 1 — Check the diagonal: All diagonal entries of A are 0, as required for skew-symmetry.

Step 2 — Check off-diagonal pairs: $a_{12} = 2,\ a_{21} = -2$; $a_{13} = -3,\ a_{31} = 3$; $a_{23} = 5,\ a_{32} = -5$. Each pair satisfies $a_{ji} = -a_{ij}$, so $A^T = -A$.

Why other options are wrong:

- (A) Symmetric needs $a_{ij} = a_{ji}$, but here they are negatives.
- (B) An identity matrix has 1s on the diagonal.
- (D) A scalar matrix is diagonal with equal entries; A has nonzero off-diagonal terms.

Final Answer: A is skew-symmetric $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q12

Q13.

Solution

Concept — Area via determinant: The area of a triangle with vertices $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ is $\frac{1}{2}\left| x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) \right|$.

Step 1 — Substitute the vertices: $(1, 1), (4, 1), (4, 5)$:

$$\Delta = \frac{1}{2}\left| 1(1-5) + 4(5-1) + 4(1-1) \right| = \frac{1}{2}\left| -4 + 16 + 0 \right| = \frac{1}{2}(12) = 6.$$

Step 2 — Geometric check: The triangle is right-angled with legs 3 (horizontal) and 4 (vertical), area $\frac{1}{2} \cdot 3 \cdot 4 = 6$. ✓

Why other options are wrong:

- (B) 12 forgets the factor $\frac{1}{2}$.
- (C) 3 halves the correct area.
- (D) 9 comes from an arithmetic slip.

Final Answer: Area $= 6$ square units $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Continuity vs differentiability: The modulus function is continuous everywhere, but it has a sharp corner at the point where its argument is zero, where the left and right derivatives differ.

Step 1 — Continuity: $f(x) = |x - 3|$ is a composition of continuous functions, so it is continuous for all real x, including $x = 3$.

Step 2 — One-sided derivatives at $x = 3$: For $x > 3$, $f(x) = x - 3$ gives slope $+1$; for $x < 3$, $f(x) = 3 - x$ gives slope -1. Since $+1 \neq -1$, f is not differentiable at $x = 3$.

Why other options are wrong:

- (A) It fails differentiability exactly at $x = 3$.
- (C) It is continuous (not discontinuous) at $x = 3$.
- (D) It is differentiable everywhere *except* $x = 3$.

Final Answer: Continuous everywhere, not differentiable at $x = 3 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Slope of a tangent: The slope of the tangent to $y = f(x)$ at a point equals $\frac{dy}{dx}$ evaluated there.

Step 1 — Differentiate: For $y = x^2$, $\frac{dy}{dx} = 2x$.

Step 2 — Evaluate at $(2, 4)$: Slope $= 2(2) = 4$. (The tangent line is $y - 4 = 4(x - 2)$, i.e. $y = 4x - 4$, as drawn.)

Why other options are wrong:

- (A) 2 uses x itself instead of $2x$.
- (B) 8 squares the slope or uses $4x$ at the wrong point.
- (D) $\frac{1}{4}$ is the slope of the *normal*, not the tangent.

Final Answer: Slope $= 4 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Definite integral: Integrate term by term using $\int x^n\,dx = \dfrac{x^{n+1}}{n+1}$, then apply the limits.

Step 1 — Antiderivative: $\int (3x^2 + 2x)\,dx = x^3 + x^2$.

Step 2 — Apply limits 0 **to** 1**:** $\left[x^3 + x^2\right]_0^1 = (1+1) - (0) = 2$.

Why other options are wrong:

- (A) 1 keeps only the x^3 term.
- (B) 3 forgets to apply limits (uses the integrand's coefficient).
- (C) $\frac{5}{2}$ comes from mis-integrating $2x$.

Final Answer: The integral equals $2 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Area between a curve and a horizontal line: The enclosed area is $\int(\text{upper} - \text{lower})\,dx$ over the interval where they bound the region.

Step 1 — Intersection points: $x^2 = 4 \Rightarrow x = \pm 2$. Between $x = -2$ and $x = 2$ the line $y = 4$ is above the parabola $y = x^2$.

Step 2 — Set up and integrate:

$$A = \int_{-2}^{2} (4 - x^2)\,dx = 2\int_0^2 (4 - x^2)\,dx = 2\left[4x - \frac{x^3}{3}\right]_0^2 = 2\left(8 - \frac{8}{3}\right) = 2 \cdot \frac{16}{3} = \frac{32}{3}.$$

Why other options are wrong:

- (B) $\frac{16}{3}$ integrates over $[0, 2]$ only (forgets symmetry).
- (C) $\frac{8}{3}$ is the area under $y = x^2$ on $[0, 2]$, not the region.
- (D) 16 ignores the parabola entirely (rectangle area).

Final Answer: Area $= \dfrac{32}{3}$ square units $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Variable-separable equations: Rearrange so each side involves one variable, then integrate both sides.

Step 1 — Separate: $\frac{dy}{dx} = \frac{x}{y} \Rightarrow y\,dy = x\,dx.$

Step 2 — Integrate: $\int y\,dy = \int x\,dx \Rightarrow \frac{y^2}{2} = \frac{x^2}{2} + C_1.$

Step 3 — Tidy up: Multiply by 2 and rename the constant: $y^2 - x^2 = C.$

Why other options are wrong:

- (B) $x^2 - y^2 = C$ has the sign reversed (would need $y\,dy = -x\,dx$).
- (C) $y^2 + x^2 = C$ would come from $\frac{dy}{dx} = -\frac{x}{y}$.
- (D) $y = Cx$ solves $\frac{dy}{dx} = \frac{y}{x}$, a different equation.

Final Answer: $y^2 - x^2 = C \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q18

Q19.

Solution

Concept — Area as a cross product: The area of the parallelogram with adjacent side vectors $\vec{a}$ and $\vec{b}$ is $|\vec{a} \times \vec{b}|$.

Step 1 — Vectors: $\vec{a} = 2\hat{\imath}$ and $\vec{b} = 3\hat{\jmath}$ (treated in the xy-plane, z-components zero).

Step 2 — Cross product: $\vec{a} \times \vec{b} = (2\hat{\imath}) \times (3\hat{\jmath}) = 6(\hat{\imath} \times \hat{\jmath}) = 6\hat{k}.$

Step 3 — Magnitude: $|\vec{a} \times \vec{b}| = |6\hat{k}| = 6.$ (Geometrically, a rectangle with sides 2 and 3 has area 6.)

Why other options are wrong:

- (A) 5 adds the magnitudes $(2 + 3)$ instead of multiplying.
- (B) $\sqrt{13}$ is $|\vec{a} + \vec{b}|$, the diagonal length, not the area.
- (D) 3 uses only $|\vec{b}|$.

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

Answer: (C) Go Back to Q19

Q20.

Solution

Concept — Bayes' theorem: $P(Y \mid D) = \dfrac{P(Y)\,P(D \mid Y)}{P(X)\,P(D \mid X) + P(Y)\,P(D \mid Y)}$.

Step 1 — List the data: $P(X) = 0.6,\ P(Y) = 0.4$; $P(D \mid X) = 0.02,\ P(D \mid Y) = 0.03$.

Step 2 — Weighted defect probabilities: $P(X)P(D \mid X) = 0.6 \times 0.02 = 0.012$; $P(Y)P(D \mid Y) = 0.4 \times 0.03 = 0.012$.

Step 3 — Apply Bayes:

$$P(Y \mid D) = \frac{0.012}{0.012 + 0.012} = \frac{0.012}{0.024} = \frac{1}{2}.$$

Why other options are wrong:

- (A) $\frac{2}{5}$ is the prior $P(Y)$, ignoring the defect evidence.
- (B) $\frac{3}{5}$ is the prior $P(X)$, not the required posterior.
- (C) $\frac{1}{3}$ uses only the defect rates ($2 : 3$, a wrong normalisation).

Final Answer: $P(Y \mid D) = \dfrac{1}{2} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Answer Key

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