INSPY TUITION

We've gathered the **most challenging multiple-choice Calculus questions** from the **VCE Math Methods exams** between **2017 and 2023**. In our upcoming FREE workshop, these questions will be thoroughly **covered and analyzed**, giving students the tools and strategies to **solve them with ease**. The focus will be on breaking down complex problems into simpler steps and providing key insights to tackle them confidently, just in time for the exams!
Fill the form to reserve your seat!
https://forms.gle/5kWNC9KFmUSYLKwTA

Two functions, p and q, are continuous over their domains, which are $[-2, 3)$ and $(-1, 5]$, respectively.
The domain of the sum function $p + q$ is

A. $[-2, 5]$
B. $[-2, -1) \cup (3, 5]$
C. $[-2, -1) \cup (-1, 3) \cup (3, 5]$
D. $[-1, 3]$
E. $(-1, 3)$

VCE 2023 47%

Suppose that $\int_3^{10} f(x)dx = C$ and $\int_7^{10} f(x)dx = D$. The value of $\int_7^{3} f(x)dx$ is

A. $C + D$
B. $C + D - 3$
C. $C - D$
D. $D - C$
E. $CD - 3$

VCE 2023 49%

The function f is given by

$$f(x)=\begin{cases}\tan\left(\frac{x}{2}\right) & 4\le x<2\pi\\ \sin(ax) & 2\pi\le x\le 8\end{cases}$$

The value of a for which f is continuous and smooth at $x=2\pi$ is

A. -2

B. $-\frac{\pi}{2}$

C. $-\frac{1}{2}$

D. $\frac{1}{2}$

E. 2

VCE 2023 42%

Two functions, f and g, are continuous and differentiable for all $x \in R$. It is given that $f(-2)=-7$, $g(-2)=8$ and $f'(-2)=3$, $g'(-2)=2$.

The gradient of the graph $y=f(x)\times g(x)$ at the point where $x=-2$ is

A. -10

B. -6

C. 0

D. 6

E. 10

VCE 2023 22%

A polynomial has the equation $y=x(3x-1)(x+3)(x+1)$.

The number of tangents to this curve that pass through the positive x-intercept is

A. 0

B. 1

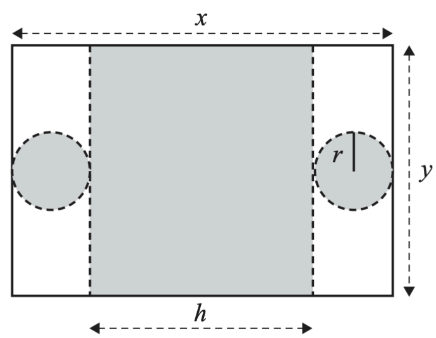
C. 2

D. 3

E. 4

VCE 2023 29%

A cylinder of height h and radius r is formed from a thin rectangular sheet of metal of length x and width y, by cutting along the dashed lines shown below.



The volume of the cylinder, in terms of x and y, is given by

A. $\pi x^2 y$

B. $\dfrac{\pi x y^2 - 2y^3}{4\pi^2}$

C. $\dfrac{2y^3 - \pi x y^2}{4\pi^2}$

D. $\dfrac{\pi x y - 2y^2}{2\pi}$

E. $\dfrac{2y^2 - \pi x y}{2\pi}$

VCE 2023 28%

Consider the function $f : [-a\pi, a\pi] \to R, f(x) = \sin(ax)$, where a is a positive integer.

The number of local minima in the graph of $y = f(x)$ is always equal to

A. 2

B. 4

C. a

D. $2a$

E. a^2

VCE 2023 29%

Find all values of k, such that the equation $x^2 + (4k+3)x + 4k^2 - \frac{9}{4} = 0$ has two real solutions for x, one positive and one negative.

A. $k > -\frac{3}{4}$

B. $k \geq -\frac{3}{4}$

C. $k > \frac{3}{4}$

D. $-\frac{3}{4} < k < \frac{3}{4}$

E. $k < -\frac{3}{4}$ or $k > \frac{3}{4}$

VCE 2023 32%

Let $f(x) = \log_e\left(x + \frac{1}{\sqrt{2}}\right)$.

Let $g(x) = \sin(x)$ where $x \in (-\infty, 5)$.

The largest interval of x values for which $(f \circ g)(x)$ and $(g \circ f)(x)$ both exist is

A. $\left(-\frac{1}{\sqrt{2}}, \frac{5\pi}{4}\right)$

B. $\left[-\frac{1}{\sqrt{2}}, \frac{5\pi}{4}\right)$

C. $\left(-\frac{\pi}{4}, \frac{5\pi}{4}\right)$

D. $\left[-\frac{\pi}{4}, \frac{5\pi}{4}\right]$

E. $\left[-\frac{\pi}{4}, -\frac{1}{\sqrt{2}}\right]$

VCE 2023 30%

Which of the pairs of functions below are **not** inverse functions?

A. $\begin{cases} f(x) = 5x + 3 & x \in R \\ g(x) = \dfrac{x-3}{5} & x \in R \end{cases}$

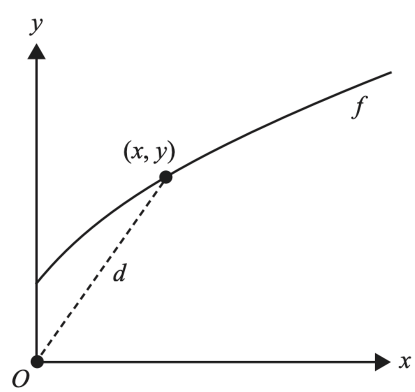
B. $\begin{cases} f(x) = \dfrac{2}{3}x + 2 & x \in R \\ g(x) = \dfrac{3}{2}x - 3 & x \in R \end{cases}$

C. $\begin{cases} f(x) = x^2 & x < 0 \\ g(x) = \sqrt{x} & x > 0 \end{cases}$

D. $\begin{cases} f(x) = \dfrac{1}{x} & x \neq 0 \\ g(x) = \dfrac{1}{x} & x \neq 0 \end{cases}$

E. $\begin{cases} f(x) = \log_e(x) + 1 & x > 0 \\ g(x) = e^{x-1} & x \in R \end{cases}$

VCE 2022 47%



Let $f : [0, \infty) \to R,\ f(x) = \sqrt{2x+1}$.

The shortest distance, d, from the origin to the point (x, y) on the graph of f is given by

A. $d = x^2 + 2x + 1$

B. $d = x^2 + \sqrt{2x+1}$

C. $d = \sqrt{x^2 - 2x + 1}$

D. $d = x + 1$

E. $d = 2x + 1$

VCE 2022 50%

The function $f(x)=\log_e\left(\frac{x+a}{x-a}\right)$, where a is a positive real constant, has the maximal domain

A. $[-a, a]$

B. $(-a, a)$

C. $R \setminus [-a, a]$

D. $R \setminus (-a, a)$

E. R

VCE 2022 39%

A function g is continuous on the domain $x \in [a, b]$ and has the following properties:

- The average rate of change of g between $x = a$ and $x = b$ is positive.
- The instantaneous rate of change of g at $x = \frac{a+b}{2}$ is negative.

Therefore, on the interval $x \in [a, b]$, the function must be

A. many-to-one.

B. one-to-many.

C. one-to-one.

D. strictly decreasing.

E. strictly increasing.

VCE 2022 39%

A box is formed from a rectangular sheet of cardboard, which has a width of a units and a length of b units, by first cutting out squares of side length x units from each corner and then folding upwards to form a container with an open top.

The maximum volume of the box occurs when x is equal to

A. $\frac{a-b+\sqrt{a^2-ab+b^2}}{6}$

B. $\frac{a+b+\sqrt{a^2-ab+b^2}}{6}$

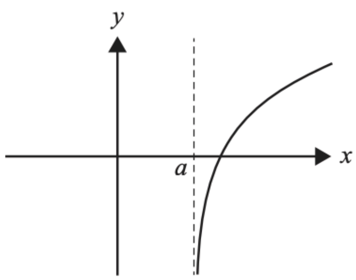
C. $\frac{a-b-\sqrt{a^2-ab+b^2}}{6}$

D. $\frac{a+b-\sqrt{a^2-ab+b^2}}{6}$

E. $\frac{a+b-\sqrt{a^2-2ab+b^2}}{6}$

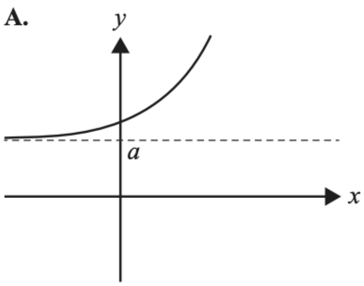
VCE 2022 34%

The graph of the function f is shown below.

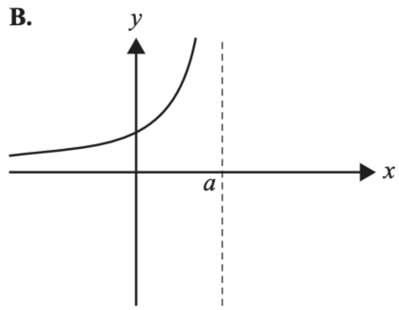


The graph corresponding to f' is

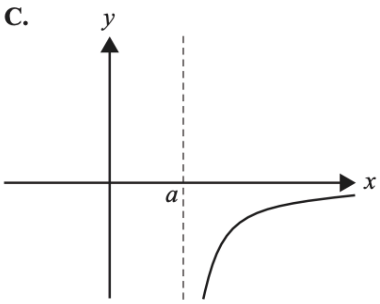
A.



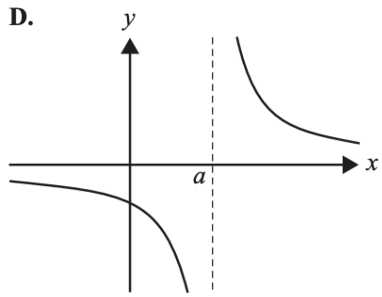
B.



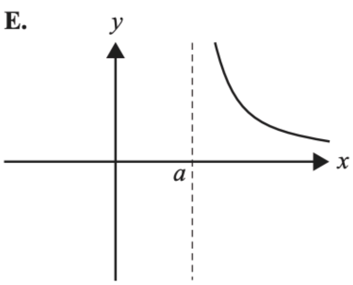
C.



D.



E.



VCE 2021 40%

Let $\cos(x) = \frac{3}{5}$ and $\sin^2(y) = \frac{25}{169}$, where $x \in \left[\frac{3\pi}{2},\ 2\pi\right]$ and $y \in \left[\frac{3\pi}{2},\ 2\pi\right]$.

The value of $\sin(x) + \cos(y)$ is

A. $\frac{8}{65}$

B. $-\frac{112}{65}$

C. $\frac{112}{65}$

D. $-\frac{8}{65}$

E. $\frac{64}{65}$

VCE 2021 31%

Which one of the following functions is differentiable for all real values of x?

A. $f(x) = \begin{cases} x & x < 0 \\ -x & x \geq 0 \end{cases}$

B. $f(x) = \begin{cases} x & x < 0 \\ -x & x > 0 \end{cases}$

C. $f(x) = \begin{cases} 8x + 4 & x < 0 \\ (2x+1)^2 & x \geq 0 \end{cases}$

D. $f(x) = \begin{cases} 2x + 1 & x < 0 \\ (2x+1)^2 & x \geq 0 \end{cases}$

E. $f(x) = \begin{cases} 4x + 1 & x < 0 \\ (2x+1)^2 & x \geq 0 \end{cases}$

VCE 2021 35%

Let $f : R \to R$, $f(x) = (2x - 1)(2x + 1)(3x - 1)$ and $g : (-\infty, 0) \to R$, $g(x) = x \log_e(-x)$.

The maximum number of solutions for the equation $f(x - k) = g(x)$, where $k \in R$, is

A. 0

B. 1

C. 2

D. 3

E. 4

VCE 2021 39%

Let $p(x) = x^3 - 2ax^2 + x - 1$, where $a \in R$. When p is divided by $x + 2$, the remainder is 5.
The value of a is

A. 2

B. $-\frac{7}{4}$

C. $\frac{1}{2}$

D. $-\frac{3}{2}$

E. -2

VCE 2020 56%

If $\int_4^8 f(x)dx = 5$, then $\int_0^2 f\left(2(x+2)\right)dx$ is equal to

A. 12

B. 10

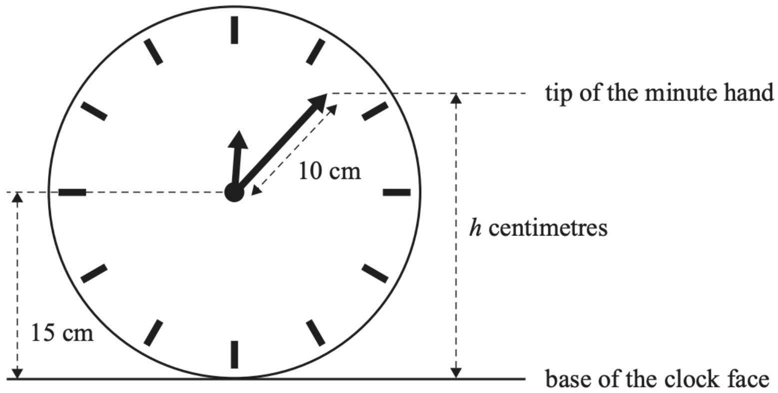
C. 8

D. $\frac{1}{2}$

E. $\frac{5}{2}$

VCE 2020 35%

A clock has a minute hand that is 10 cm long and a clock face with a radius of 15 cm, as shown below.



At 12.00 noon, both hands of the clock point vertically upwards and the tip of the minute hand is at its maximum distance above the base of the clock face.

The height, h centimetres, of the tip of the minute hand above the base of the clock face t minutes after 12.00 noon is given by

A. $h(t) = 15 + 10\sin\left(\frac{\pi t}{30}\right)$

B. $h(t) = 15 - 10\sin\left(\frac{\pi t}{30}\right)$

C. $h(t) = 15 + 10\sin\left(\frac{\pi t}{60}\right)$

D. $h(t) = 15 + 10\cos\left(\frac{\pi t}{60}\right)$

E. $h(t) = 15 + 10\cos\left(\frac{\pi t}{30}\right)$

VCE 2020 45%

The transformation $T : R^2 \to R^2$ that maps the graph of $y = \cos(x)$ onto the graph of $y = \cos(2x + 4)$ is

A. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} \frac{1}{2} & 0 \\ 0 & 1 \end{bmatrix}\left(\begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} -4 \\ 0 \end{bmatrix}\right)$

B. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} \frac{1}{2} & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} -4 \\ 0 \end{bmatrix}$

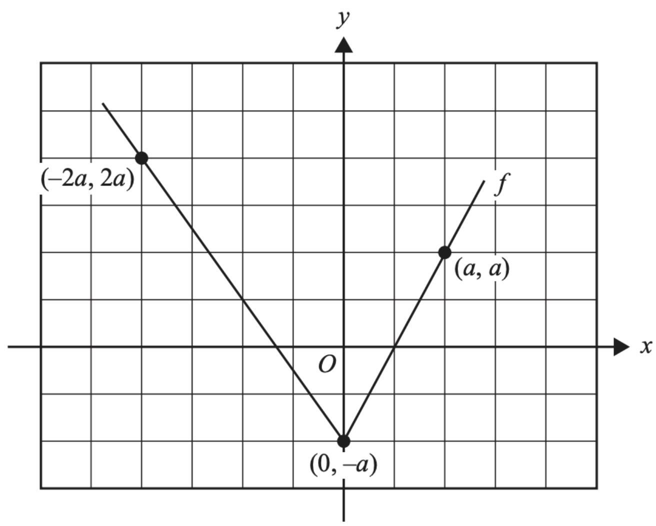
C. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} \frac{1}{2} & 0 \\ 0 & 1 \end{bmatrix}\left(\begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} -2 \\ 0 \end{bmatrix}\right)$

D. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}\left(\begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 2 \\ 0 \end{bmatrix}\right)$

E. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 2 \\ 0 \end{bmatrix}$

VCE 2020 26%

Part of the graph of a function f, where $a > 0$, is shown below.



The average value of the function f over the interval $[-2a, a]$ is

A. 0

B. $\frac{a}{3}$

C. $\frac{a}{2}$

D. $\frac{3a}{4}$

E. a

VCE 2020 32%

Let $f(x) = -\log_e(x + 2)$.

A tangent to the graph of f has a vertical axis intercept at $(0, c)$.

The maximum value of c is

A. -1

B. $-1 + \log_e(2)$

C. $-\log_e(2)$

D. $-1 - \log_e(2)$

E. $\log_e(2)$

VCE 2020 42%

Let $a \in (0, \infty)$ and $b \in R$.

Consider the function $h:[-a, 0) \cup (0, a] \to R, h(x) = \frac{a}{x} + b$.

The range of h is

A. $[b - 1, b + 1]$

B. $(b - 1, b + 1)$

C. $(-\infty, b - 1) \cup (b + 1, \infty)$

D. $(-\infty, b - 1] \cup [b + 1, \infty)$

E. $[b - 1, \infty)$

VCE 2020 43%

Let $f: R \to R, f(x) = \cos(ax)$, where $a \in R \backslash \{0\}$, be a function with the property

$$f(x) = f(x + h), \text{ for all } h \in Z$$

Let $g: D \to R, g(x) = \log_2(f(x))$ be a function where the range of g is $[-1, 0]$.

A possible interval for D is

A. $\left[\frac{1}{4}, \frac{5}{12}\right]$

B. $\left[1, \frac{7}{6}\right]$

C. $\left[\frac{5}{3}, 2\right]$

D. $\left[-\frac{1}{3}, 0\right]$

E. $\left[-\frac{1}{12}, \frac{1}{4}\right]$

VCE 2020 18%

If $\int_1^4 f(x)\,dx = 4$ and $\int_2^4 f(x)\,dx = -2$, then $\int_1^2 (f(x) + x)\,dx$ is equal to

A. 2

B. 6

C. 8

D. $\frac{7}{2}$

E. $\frac{15}{2}$

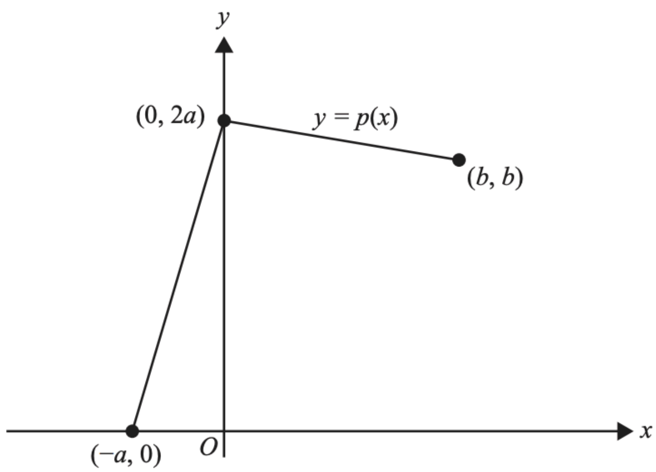
VCE 2019 38%

The distribution of a continuous random variable, X, is defined by the probability density function f, where

$$f(x) = \begin{cases} p(x) & -a \le x \le b \\ 0 & \text{otherwise} \end{cases}$$

and $a, b \in R^+$.

The graph of the function p is shown below.



It is known that the average value of p over the interval $[-a, b]$ is $\frac{3}{4}$.

$\Pr(X > 0)$ is

A. $\frac{2}{3}$

B. $\frac{3}{4}$

C. $\frac{4}{5}$

D. $\frac{7}{9}$

E. $\frac{5}{6}$

VCE 2019 27%

Given that $\tan(\alpha) = d$, where $d > 0$ and $0 < \alpha < \frac{\pi}{2}$, the sum of the solutions to $\tan(2x) = d$, where $0 < x < \frac{5\pi}{4}$, in terms of α, is

A. 0

B. 2α

C. $\pi + 2\alpha$

D. $\frac{\pi}{2} + \alpha$

E. $\frac{3(\pi + \alpha)}{2}$

VCE 2019 25%

The expression $\log_x(y) + \log_y(z)$, where x, y and z are all real numbers greater than 1, is equal to

A. $-\frac{1}{\log_y(x)} - \frac{1}{\log_z(y)}$

B. $\frac{1}{\log_x(y)} + \frac{1}{\log_y(z)}$

C. $-\frac{1}{\log_x(y)} - \frac{1}{\log_y(z)}$

D. $\frac{1}{\log_y(x)} + \frac{1}{\log_z(y)}$

E. $\log_y(x) + \log_z(y)$

VCE 2019 47%

Consider the function $f:[a, b) \to R, f(x) = \frac{1}{x}$, where a and b are positive real numbers.
The range of f is

A. $\left[\frac{1}{a}, \frac{1}{b}\right)$

B. $\left(\frac{1}{a}, \frac{1}{b}\right]$

C. $\left[\frac{1}{b}, \frac{1}{a}\right)$

D. $\left(\frac{1}{b}, \frac{1}{a}\right]$

E. $[a, b)$

VCE 2018 48%

The point $A(3, 2)$ lies on the graph of the function f. A transformation maps the graph of f to the graph of g, where $g(x) = \frac{1}{2} f(x-1)$. The same transformation maps the point A to the point P.

The coordinates of the point P are

A. (2, 1)

B. (2, 4)

C. (4, 1)

D. (4, 2)

E. (4, 4)

VCE 2018 48%

If $\int_1^{12} g(x)\,dx = 5$ and $\int_{12}^{5} g(x)\,dx = -6$, then $\int_1^{5} g(x)\,dx$ is equal to

A. –11

B. –1

C. 1

D. 3

E. 11

VCE 2018 41%

The graph of $y = \tan(ax)$, where $a \in R^+$, has a vertical asymptote $x = 3\pi$ and has exactly one x-intercept in the region $(0, 3\pi)$.

The value of a is

A. $\frac{1}{6}$

B. $\frac{1}{3}$

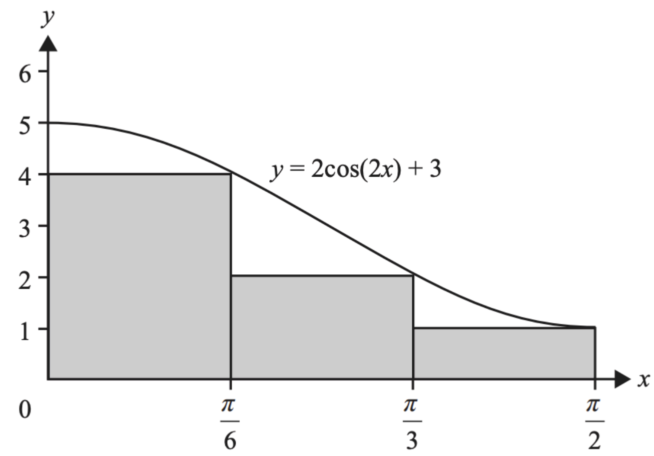
C. $\frac{1}{2}$

D. 1

E. 2

VCE 2018 26%

Jamie approximates the area between the x-axis and the graph of $y = 2\cos(2x) + 3$, over the interval $\left[0, \frac{\pi}{2}\right]$, using the three rectangles shown below.



Jamie's approximation as a fraction of the exact area is

A. $\frac{5}{9}$

B. $\frac{7}{9}$

C. $\frac{9}{11}$

D. $\frac{11}{18}$

E. $\frac{7}{3}$

VCE 2018 49%

The turning point of the parabola $y = x^2 - 2bx + 1$ is closest to the origin when

A. $b = 0$

B. $b = -1$ or $b = 1$

C. $b = -\frac{1}{\sqrt{2}}$ or $b = \frac{1}{\sqrt{2}}$

D. $b = \frac{1}{2}$ or $b = -\frac{1}{2}$

E. $b = \frac{1}{4}$ or $b = -\frac{1}{4}$

VCE 2018 45%

Question 18

Consider the functions $f: R^+ \to R,\ f(x) = x^{\frac{p}{q}}$ and $g: R^+ \to R,\ g(x) = x^{\frac{m}{n}}$, where p, q, m and n are positive integers, and $\frac{p}{q}$ and $\frac{m}{n}$ are fractions in simplest form.

If $\{x : f(x) > g(x)\} = (0, 1)$ and $\{x : g(x) > f(x)\} = (1, \infty)$, which of the following must be **false**?

A. $q > n$ and $p = m$

B. $m > p$ and $q = n$

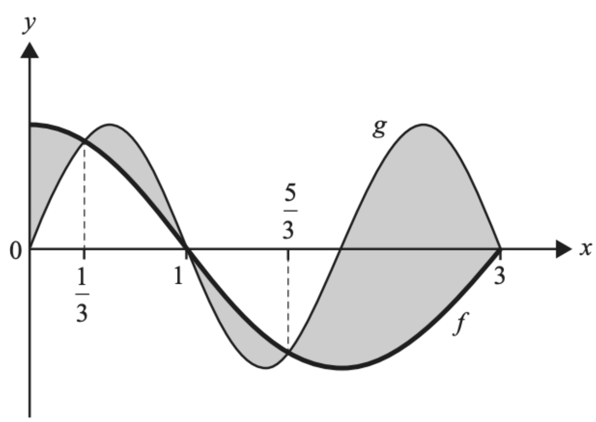
C. $pn < qm$

D. $f'(c) = g'(c)$ for some $c \in (0, 1)$

E. $f'(d) = g'(d)$ for some $d \in (1, \infty)$

VCE 2018 14%

The graphs $f: R \to R,\ f(x) = \cos\left(\frac{\pi x}{2}\right)$ and $g: R \to R,\ g(x) = \sin(\pi x)$ are shown in the diagram below.



An integral expression that gives the total area of the shaded regions is

A. $\int_0^3 \left(\sin(\pi x) - \cos\left(\frac{\pi x}{2}\right)\right) dx$

B. $2\int_{\frac{5}{3}}^3 \left(\sin(\pi x) - \cos\left(\frac{\pi x}{2}\right)\right) dx$

C. $\int_0^{\frac{1}{3}} \left(\cos\left(\frac{\pi x}{2}\right) - \sin(\pi x)\right) dx - 2\int_{\frac{1}{3}}^1 \left(\cos\left(\frac{\pi x}{2}\right) - \sin(\pi x)\right) dx - \int_{\frac{5}{3}}^3 \left(\cos\left(\frac{\pi x}{2}\right) - \sin(\pi x)\right) dx$

D. $2\int_1^{\frac{5}{3}} \left(\cos\left(\frac{\pi x}{2}\right) - \sin(\pi x)\right) dx - 2\int_{\frac{5}{3}}^3 \left(\cos\left(\frac{\pi x}{2}\right) - \sin(\pi x)\right) dx$

E. $\int_0^{\frac{1}{3}} \left(\cos\left(\frac{\pi x}{2}\right) - \sin(\pi x)\right) dx + 2\int_{\frac{1}{3}}^1 \left(\sin(\pi x) - \cos\left(\frac{\pi x}{2}\right)\right) dx + \int_{\frac{5}{3}}^3 \left(\cos\left(\frac{\pi x}{2}\right) - \sin(\pi x)\right) dx$

VCE 2018 41%

The differentiable function $f : R \to R$ is a probability density function. It is known that the median of the probability density function f is at $x = 0$ and $f'(0) = 4$.

The transformation $T : R^2 \to R^2$ maps the graph of f to the graph of g, where $g : R \to R$ is a probability density function with a median at $x = 0$ and $g'(0) = -1$.

The transformation T could be given by

A. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} -2 & 0 \\ 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$

B. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} 2 & 0 \\ 0 & \frac{-1}{2} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$

C. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} 2 & 0 \\ 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$

D. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} -\frac{1}{2} & 0 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$

E. $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} \frac{1}{2} & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$

VCE 2018 20%

The equation $(p - 1)x^2 + 4x = 5 - p$ has no real roots when

A. $p^2 - 6p + 6 < 0$
B. $p^2 - 6p + 1 > 0$
C. $p^2 - 6p - 6 < 0$
D. $p^2 - 6p + 1 < 0$
E. $p^2 - 6p + 6 > 0$

VCE 2017 32%

Question 10

A transformation $T: R^2 \to R^2$ with rule $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} 2 & 0 \\ 0 & \frac{1}{3} \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}$ maps the graph of $y = 3\sin\left(2\left(x + \frac{\pi}{4}\right)\right)$ onto the graph of

A. $y = \sin(x + \pi)$

B. $y = \sin\left(x - \frac{\pi}{2}\right)$

C. $y = \cos(x + \pi)$

D. $y = \cos(x)$

E. $y = \cos\left(x - \frac{\pi}{2}\right)$

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Question 12

The sum of the solutions of $\sin(2x) = \frac{\sqrt{3}}{2}$ over the interval $[-\pi, d]$ is $-\pi$.

The value of d could be

A. 0

B. $\frac{\pi}{6}$

C. $\frac{3\pi}{4}$

D. $\frac{7\pi}{6}$

E. $\frac{3\pi}{2}$

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Question 13

Let $h: (-1, 1) \to R$, $h(x) = \frac{1}{x-1}$.

Which one of the following statements about h is **not** true?

A. $h(x)h(-x) = -h(x^2)$

B. $h(x) + h(-x) = 2h(x^2)$

C. $h(x) - h(0) = xh(x)$

D. $h(x) - h(-x) = 2xh(x^2)$

E. $(h(x))^2 = h(x^2)$

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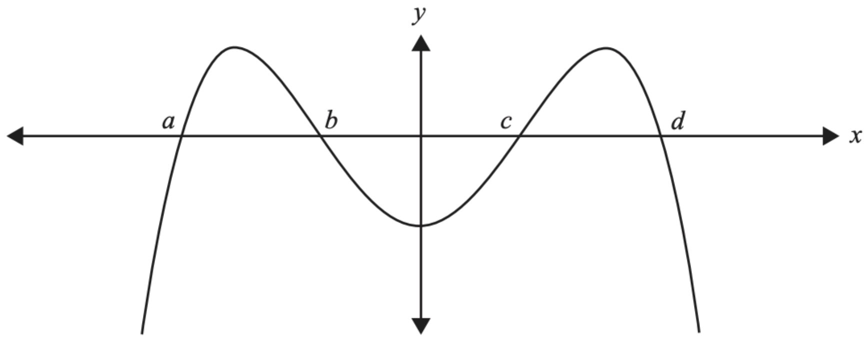
The graph of a function f, where $f(-x) = f(x)$, is shown below.



The graph has x-intercepts at $(a, 0)$, $(b, 0)$, $(c, 0)$ and $(d, 0)$ only.
The area bound by the curve and the x-axis on the interval $[a, d]$ is

A. $\int_a^d f(x)\,dx$

B. $\int_a^b f(x)\,dx - \int_c^b f(x)\,dx + \int_c^d f(x)\,dx$

C. $2\int_a^b f(x)\,dx + \int_b^c f(x)\,dx$

D. $2\int_a^b f(x)\,dx - 2\int_b^{b+c} f(x)\,dx$

E. $\int_a^b f(x)\,dx + \int_c^b f(x)\,dx + \int_d^c f(x)\,dx$

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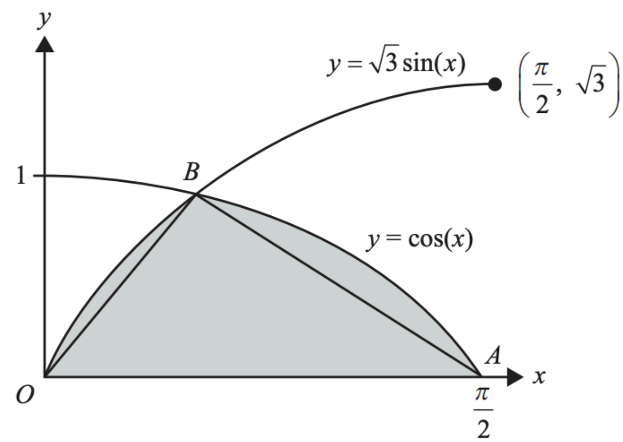
Question 20

The graphs of $f:\left[0, \frac{\pi}{2}\right] \to R, f(x) = \cos(x)$ and $g:\left[0, \frac{\pi}{2}\right] \to R, g(x) = \sqrt{3}\sin(x)$ are shown below.

The graphs intersect at B.



The ratio of the area of the shaded region to the area of triangle OAB is

A. $9 : 8$

B. $\sqrt{3} - 1 : \frac{\sqrt{3}\pi}{8}$

C. $8\sqrt{3} - 3 : 3\pi$

D. $\sqrt{3} - 1 : \frac{\sqrt{3}\pi}{4}$

E. $1 : \frac{\sqrt{3}\pi}{8}$

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