CANDIDATE REGISTRATION NO.

PRINT your name on the line below return this booklet with the answer sheet. Failure to do so may result in disqualification.

FORM TP 2016036

TEST CODE **01254010**

MAY/JUNE 2016

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®

EXAMINATION

ADDITIONAL MATHEMATICS

Paper 01 – General Proficiency

1 hour 30 minutes

06 JUNE 2016 (p.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 45 items. You will have 1 hour and 30 minutes to answer them.
2. In addition to this test booklet, you should have an answer sheet.
3. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
4. A list of formulae is provided on page 2 of this booklet.
5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

Sample Item

$$(4^{-2})^2 \div \left(\frac{1}{16}\right)^2 =$$

(A) 4^{-2}
(B) 4^{-1}
(C) 4^{0}
(D) 4^{2}

Sample Answer

The best answer to this item is "4^0", so (C) has been shaded.

6. If you want to change your answer, erase it completely before you fill in your new choice.
7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You can return to that item later.
8. You may use silent, non-programmable calculators to answer items.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

LIST OF FORMULAE

Arithmetic Series $T_n = a + (n-1)d \qquad S_n = \frac{n}{2}[2a + (n-1)d]$

Geometric Series $T_n = ar^{n-1} \qquad S_n = \frac{a(r^n - 1)}{r - 1} \qquad S_\infty = \frac{a}{1-r}, \ -1 < r < 1 \text{ or } |r| < 1$

Circle $x^2 + y^2 + 2fx + 2gy + c = 0 \qquad (x+f)^2 + (y+g)^2 = r^2$

Vectors $\hat{\mathbf{v}} = \frac{\mathbf{v}}{|\mathbf{v}|} \qquad \cos\theta = \frac{\mathbf{a} \bullet \mathbf{b}}{|\mathbf{a}| \times |\mathbf{b}|} \qquad |\mathbf{v}| = \sqrt{(x^2 + y^2)} \text{ where } \mathbf{v} = x\mathbf{i} + y\mathbf{j}$

Trigonometry $\sin(A \pm B) \equiv \sin A \cos B \pm \cos A \sin B$

$\cos(A \pm B) \equiv \cos A \cos B \mp \sin A \sin B$

$\tan(A \pm B) \equiv \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

Differentiation $\frac{d}{dx}(ax + b)^n = an(ax + b)^{n-1}$

$\frac{d}{dx}\sin x = \cos x$

$\frac{d}{dx}\cos x = -\sin x$

Statistics $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}, \quad S^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n} = \frac{\sum_{i=1}^{n} f_i x_i^2}{\sum_{i=1}^{n} f_i} - (\bar{x})^2$

Probability $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Kinematics $v = u + at \qquad v^2 = u^2 + 2as \qquad s = ut + \frac{1}{2}at^2$

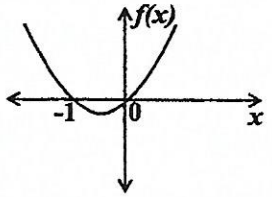
1. The function $f(x) = 2x^3 - x^2 + hx - 6$ can be expressed as $f(x) = (2x + 1)(x + 2)(x - 3)$. What is the value of h?

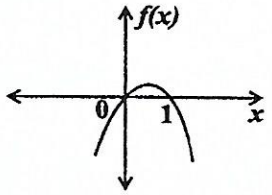
(A) -13
(B) -12
(C) 7
(D) 13

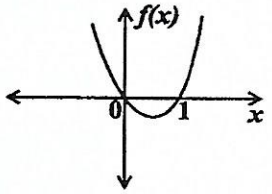
2. $\dfrac{1}{x+3} + \dfrac{3}{x^2-9}$ expressed as a single fraction is

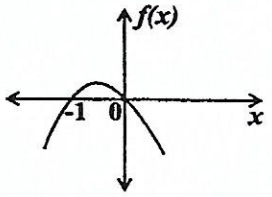
(A) $\dfrac{x}{x^2-9}$
(B) $\dfrac{x^2-6}{(x^2-9)(x+3)}$
(C) $\dfrac{x+6}{x^2-9}$
(D) $\dfrac{4}{x+3}$

3. Which of the following graphs BEST represents $f(x) = x(1 - x)$?

(A)


(B)


(C)


(D)


4. Given that $f(x) = ax^2 + bx + c$, $f(x)$ can be expressed in the form

(A) $a\left(x + \dfrac{b}{2a}\right)^2 + \dfrac{4ac - b^2}{4a^2}$
(B) $a\left(x + \dfrac{b}{a}\right)^2 + \dfrac{ac - b^2}{a}$
(C) $a\left(x + \dfrac{b}{a}\right)^2 + \dfrac{ac - b^2}{a^2}$
(D) $a\left(x + \dfrac{b}{2a}\right)^2 + \dfrac{4ac - b^2}{4a}$

5. A quadratic equation is such that the sum of its roots is $-\frac{2}{3}$ and the product of its roots is $\frac{3}{4}$. The quadratic equation is

(A) $12x^2 + 8x + 9 = 0$
(B) $12x^2 - 8x - 9 = 0$
(C) $12x^2 - 8x + 9 = 0$
(D) $12x^2 + 8x - 9 = 0$

6. The range of values for which $x^2 - 7x + 10 < 0$ is

(A) $-5 < x < 2$
(B) $2 < x < 5$
(C) $x < 2$ and $x > 5$
(D) $x < -5$ and $x > -2$

7. The set of values of x for which $\frac{2x+1}{x-1} \geq 0$ is

(A) $x \geq 1$
(B) $x \geq -\frac{1}{2}$
(C) $x \geq -\frac{1}{2}$ and $x \geq 1$
(D) $x \leq -\frac{1}{2}$ or $x \geq 1$

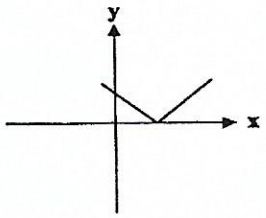
8. If $f(x) = \frac{1}{8}x^3$, $x \in \mathbf{R}$ and $-2 \leq x \leq 4$, then

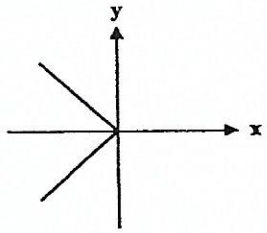
(A) $-8 \leq f(x) \leq 64$
(B) $8 \leq f(x) \leq 64$
(C) $-1 \leq f(x) \leq 8$
(D) $-2 \leq f(x) \leq 4$

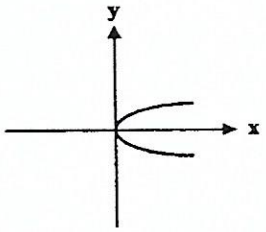
9. The functions f and g are defined by $f: x \to 2x - 5$ and $g: x \to 4 + \frac{3}{x}$, $x \neq 0$. The composite function gf is defined by

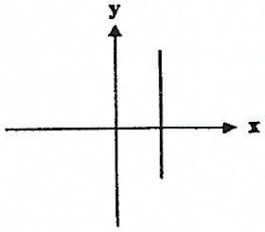
(A) $gf: x \to \frac{6}{x} - 5$, $x \neq 0$
(B) $gf: x \to 3 + \frac{6}{x}$, $x \neq 0$
(C) $gf: x \to \frac{8x-17}{2x-5}$, $x \neq \frac{5}{2}$
(D) $gf: x \to \frac{8x-20}{2x-5}$, $x \neq \frac{5}{2}$

10. Which of the following graphs is a function?

(A) 

(B) 

(C) 

(D) 

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11. A function is defined by $f: x \rightarrow \frac{1}{x+1}, x \neq -1$. The value of $f^{-1}(1)$ is

(A) 0

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

(C) 1

(D) 2

12. $\sqrt[n]{3 \times 27^m}$ is equal to

(A) $3^{\frac{4m}{n}}$

(B) 3^{n+3m}

(C) $\sqrt[n]{81^{3m}}$

(D) $3^{\frac{3m+1}{n}}$

13. The value of x for which $9^{x+1} = 3$ is

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

(B) $-\frac{1}{2}$

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

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

14. Given that $\log_p X = 6$ and $\log_p Y = 4$, the value of $\log_p \left(\frac{X}{Y}\right)$ is

(A) 10

(B) $\log_p 2$

(C) $\frac{\log_p 6}{\log_p 4}$

(D) 2

15. The expression $\frac{\sqrt{5}-1}{1+\sqrt{5}}$ when simplified is equal to

(A) $\frac{1}{3}(3-\sqrt{5})$

(B) $\frac{1}{2}(\sqrt{5}-3)$

(C) $\frac{1}{3}(\sqrt{5}-3)$

(D) $\frac{1}{2}(3-\sqrt{5})$

16. The value of x for which

$\log_3 (2x + 1) = 2 + \log_3 (3x - 11)$ is

(A) 5

(B) $\frac{23}{4}$

(C) 4

(D) $\frac{67}{16}$

17. The series $-2 + \frac{4}{3} - \frac{8}{9} + \ldots$ converges to the limit

(A) -6

(B) 6

(C) $-\frac{6}{5}$

(D) $\frac{6}{5}$

18. What is the sum of the ODD integers between 10 and 50?

(A) 60
(B) 600
(C) 630
(D) 1960

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19. The sum of the first n terms of a geometric series is $S_n = 4^n - 1$. For this series

I. the common ratio is 4
II. the first 3 terms are 3, 15 and 63
III. $S_{2n} = 2^{4n} - 1$

Which of the statements above are correct?

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

20. The sum of $\sum_{k=1}^{3} \frac{1}{k}$ is

(A) $\frac{1}{3}$
(B) $\frac{1}{2}$
(C) $\frac{3}{5}$
(D) $\frac{11}{6}$

21. The coordinates of the centre of a circle with equation $(x-1)^2 + (y+3)^2 = 36$ is

(A) $(1, -3)$
(B) $(-1, 3)$
(C) $(3, -1)$
(D) $(-3, 1)$

22. The line through the points Q(h, 2) and R(4, 8) is parallel to the line with equation $2x + y - 10 = 0$. The value of h is

(A) 1
(B) 2
(C) –7
(D) 7

23. The points of intersection of the line with equation $y - x - 2 = 0$ and the circle with equation $x^2 + y^2 = 10$ are

(A) (3, 1) and (–1, –3)
(B) (3, –1) and (1, –3)
(C) (–3, –1) and (–1, –3)
(D) (–3, –1) and (1, 3)

24. Two vectors are equal if they

(A) have the same magnitude and different directions
(B) have the same magnitude and same direction
(C) are parallel and in different directions
(D) have different magnitudes and are in the same direction

25. The vector a is given as $5i + 12j$. A unit vector parallel to a is

(A) $15i + 36j$
(B) $195i + 468j$
(C) $\frac{1}{13}(5i + 12j)$
(D) $\frac{3}{13}(5i + 12j)$

26. The position vectors of A and B relative to an origin O are $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ respectively. The acute angle AOB is given by

(A) $\cos^{-1}\left(\frac{1}{\sqrt{290}}\right)$
(B) $\cos^{-1}\left(\frac{11}{\sqrt{290}}\right)$
(C) $\cos^{-1}\left(\frac{\sqrt{11}}{\sqrt{290}}\right)$
(D) $\cos^{-1}\left(\frac{-1}{290}\right)$

27. Given that x is acute and $\cos x = \frac{3}{5}$, then the value of $\sin 2x$ is

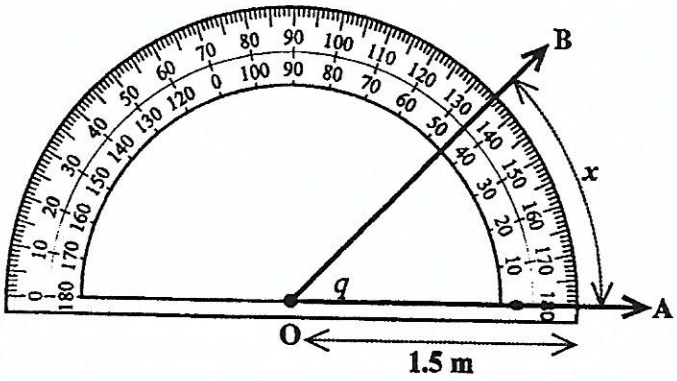
(A) $\frac{3}{5}$

(B) $\frac{4}{5}$

(C) $\frac{12}{25}$

(D) $\frac{24}{25}$

Item 28 refers to the following protractor which represents half of a circle. The protractor has a radius of 1.5 metres and the angle AOB measures 45°.



28. What is the arc length, x, in metres, along the outer edge of the protractor?

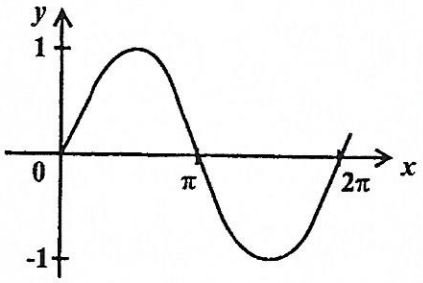
(A) $\frac{\pi}{4}$

(B) $\frac{3\pi}{8}$

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

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

29. The graph of $y = \sin 2x$ is

(A)


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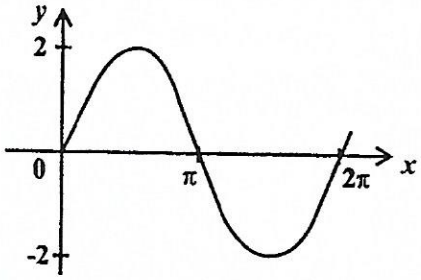

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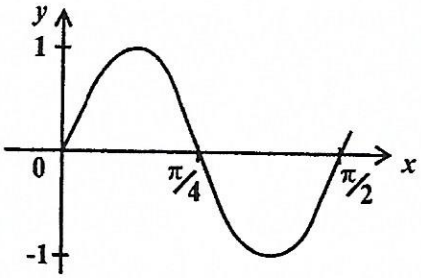

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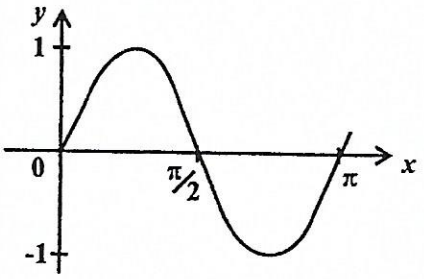

30. If $\sin(x + 20°) = \cos x$, then the value of x is

(A) 35°
(B) 45°
(C) 55°
(D) 70°

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31. $\sin(\alpha + 45°)$ is equal to

(A) $\frac{1}{\sqrt{2}}(\sin\alpha + \cos\alpha)$

(B) $\frac{1}{\sqrt{2}}(\cos\alpha - \sin\alpha)$

(C) $\frac{1}{2}(\sin\alpha + \cos\alpha)$

(D) $\frac{1}{2}(\cos\alpha - \sin\alpha)$

32. $\frac{8\pi}{5}$ radians converted to degrees is

(A) 287
(B) 288
(C) 289
(D) 576

33. If $\sin\theta = \frac{5}{13}$ and θ is **obtuse**, then $\tan\theta =$

(A) $-\frac{12}{13}$

(B) $\frac{-5}{12}$

(C) $\frac{5}{12}$

(D) $\frac{12}{13}$

34. The trigonometrical expression $\frac{\sin x}{1-\cos x} + \frac{\sin x}{1+\cos x}$ is identical to

(A) $2\sin x$

(B) $2\tan x$

(C) $\frac{2}{\sin x}$

(D) $\tan^2 x$

35. Given that $y = \sqrt{5-x}$, then $\frac{dy}{dx}$ is

(A) $-\frac{1}{\sqrt{5-x}}$

(B) $\frac{1}{\sqrt{5-x}}$

(C) $\frac{1}{2\sqrt{5-x}}$

(D) $\frac{-1}{2\sqrt{5-x}}$

36. The gradient at $x = \frac{\pi}{6}$ on the curve $y = \cos x$ is

(A) $-\frac{\sqrt{3}}{2}$

(B) $-\frac{1}{2}$

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

(D) $\frac{\sqrt{3}}{2}$

37. The curve C is given by the equation $y = 2x^3 - 3x^2 - 12x + 6$. The values of x at which stationary points occur are

(A) 1 and –2
(B) –1 and 2
(C) –1 and –2
(D) 1 and 2

38. Given $y = 2x^2 + 3\cos x$, then $\frac{dy}{dx} =$

(A) $x + \sin x$
(B) $x - \sin x$
(C) $4x - 3\sin x$
(D) $4x + 3\sin x$

39. The curve C with equation $y = f(x)$ has a stationary point at $(-2, 5)$. If $f''(x) = x^4 - 15$, then $(-2, 5)$ is

(A) an intercept
(B) a vertex
(C) a minimum turning point
(D) a maximum turning point

40. If $\int_2^a (6+3x)\,dx = 72$, where $a > 2$, then $a =$

(A) 6
(B) 10
(C) 36
(D) 72

41. The region bounded by the curve $y = x^2$, the x-axis and the lines $x = 0$ and $x = 1$ is rotated 360° about the x-axis. The volume of the solid generated can be found from

(A) $\pi\int_0^1 x^2\,dx$
(B) $\int_0^1 x^4\,dx$
(C) $\int_0^1 x^2\,dx$
(D) $\pi\int_0^1 x^4\,dx$

42. If $X = \int_a^b f(x)\,dx$ and $a < c < b$ then

(A) $X = \int_0^a f(x)\,dx + \int_0^b f(x)\,dx$
(B) $X = \int_a^c f(x)\,dx + \int_b^c f(x)\,dx$
(C) $X = \int_a^c f(x)\,dx + \int_c^b f(x)\,dx$
(D) $X = \int_0^a f(x)\,dx + \int_a^c f(x)\,dx - \int_0^b f(x)\,dx$

43. The region R is enclosed by the x-axis, the curve $y = x^2 + 2x - 1$, the lines $x = 2$ and $x = 3$. The area of R in units^2 is

(A) 15
(B) $\frac{31}{3}$
(C) $\frac{19}{3}$
(D) $\frac{59}{3}$

44. If $\int_1^4 f(x)\,dx = 6$, then $\int_1^4 4f(x)\,dx + 5 =$

(A) 9
(B) 11
(C) 29
(D) 44

45. $\int(\cos x - 2\sin x)\,dx =$

(A) $-\cos x + \sin x + c$
(B) $\cos x + 2\sin x + c$
(C) $\cos x - \sin x + c$
(D) $2\cos x + \sin x + c$

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.