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Higher Mathematics

SQA Multiple Choice Questions

2015

FORMULAE LIST

Circle:

The equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle centre $(-g, -f)$ and radius $\sqrt{g^2 + f^2 - c}$.

The equation $(x - a)^2 + (y - b)^2 = r^2$ represents a circle centre (a, b) and radius r.

Scalar Product: $\mathbf{a}.\mathbf{b} = |\mathbf{a}|\,|\mathbf{b}| \cos\theta$, where θ is the angle between $\mathbf{a}$ and $\mathbf{b}$

or $\mathbf{a}.\mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3$ where $\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$.

Trigonometric formulae:

$$\begin{aligned} \sin(A \pm B) &= \sin A \cos B \pm \cos A \sin B \\ \cos(A \pm B) &= \cos A \cos B \mp \sin A \sin B \\ \sin 2A &= 2\sin A \cos A \\ \cos 2A &= \cos^2 A - \sin^2 A \\ &= 2\cos^2 A - 1 \\ &= 1 - 2\sin^2 A \end{aligned}$$

Table of standard derivatives:

$f(x)$	$f'(x)$
$\sin ax$	$a\cos ax$
$\cos ax$	$-a\sin ax$

Table of standard integrals:

$f(x)$	$\int f(x)dx$
$\sin ax$	$-\frac{1}{a}\cos ax + c$
$\cos ax$	$\frac{1}{a}\sin ax + c$

[Turn over

SECTION A

ALL questions should be attempted.

1. Given $f(x) = 2x^3 - 7$ find the value of $f'(2)$.

A -6

B 9

C 24

D 137

2. The line with equation $2y = 3x + 5$ is perpendicular to the line with equation $y = kx$. What is the value of k?

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

B $-\frac{2}{3}$

C $\frac{2}{3}$

D $\frac{3}{2}$

3. If $2x^3 + x^2 - 4x + 1$ is divided by $(x - 2)$, what is the remainder?

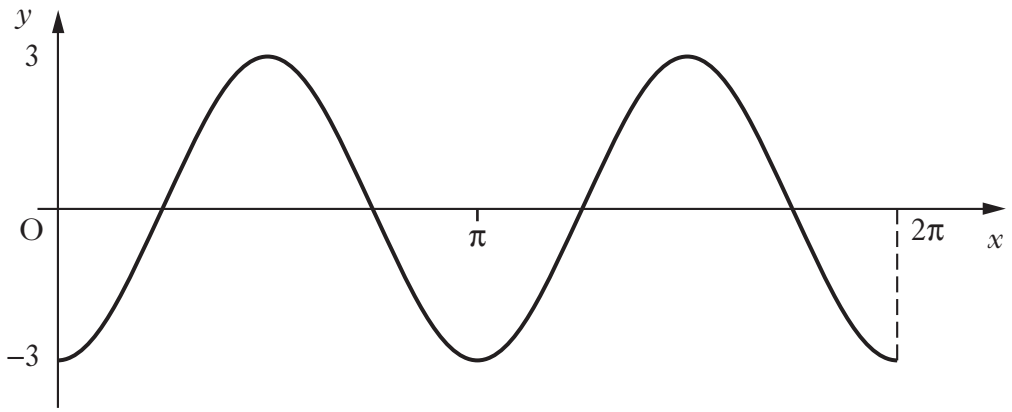
A -11

B 0

C 1

D 13

4. The diagram shows the graph with equation of the form $y = a\cos bx$ for $0 \leq x \leq 2\pi$.



What is the equation of this graph?

A $y = -3\cos 2x$

B $y = -3\cos 3x$

C $y = 3\cos 2x$

D $y = 3\cos 3x$

5. A sequence is defined by the recurrence relation $u_{n+1} = 0{\cdot}2u_n + 9$, $u_5 = 11$.
What is the value of u_3?

A 11·24

B 9·4

C 5

D 4

6. The points P, Q and R are collinear.

P is the point (–1, 6, 4), Q is the point (2, 0, 13) and $\overrightarrow{QR} = \begin{pmatrix} 2 \\ -4 \\ 6 \end{pmatrix}$.
Calculate the ratio in which Q divides PR.

A 2 : 3

B 3 : 2

C 3 : 5

D 5 : 2

7. What is $\int (x+4)(x-4)\,dx$?

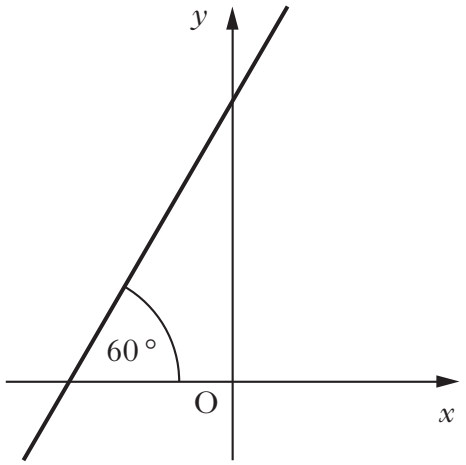
A $2x + c$

B $\frac{1}{3}x^3 + c$

C $\frac{1}{3}x^3 - 16x + c$

D $\left(\frac{1}{2}x^2 + 4x\right)\left(\frac{1}{2}x^2 - 4x\right) + c$

8. A straight line makes an angle of $60°$ with the x-axis as shown in the diagram.



What is the gradient of this line?

A $\frac{1}{2}$

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

C $\frac{\sqrt{3}}{2}$

D $\sqrt{3}$

9. Find the minimum value of $3\sin 2x + 5$ and the value of x where this occurs in the interval $0 \leq x < \pi$.

	min value	x
A	2	$\frac{3\pi}{2}$
B	2	$\frac{3\pi}{4}$
C	4	$\frac{3\pi}{2}$
D	4	$\frac{3\pi}{4}$

10. Solve $2\cos x + 1 = 0$ for x, where $\pi \leq x \leq \frac{3\pi}{2}$.

A $\frac{5\pi}{6}$

B $\frac{7\pi}{6}$

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

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

11. The curve $y = f(x)$ is such that $f'(x) = 4x - 1$.

The curve passes through the point (2, 9).

What is the equation of the curve?

A $y = 2x^2 - x - 5$

B $y = 2x^2 + 1$

C $y = 2x^2 - x + 3$

D $y = 2x^2 - x$

[Turn over

12. Given that the point R is (3, –1, 2), $\overrightarrow{RS} = \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix}$ and $\overrightarrow{RT} = 3\overrightarrow{RS}$,

find the coordinates of T.

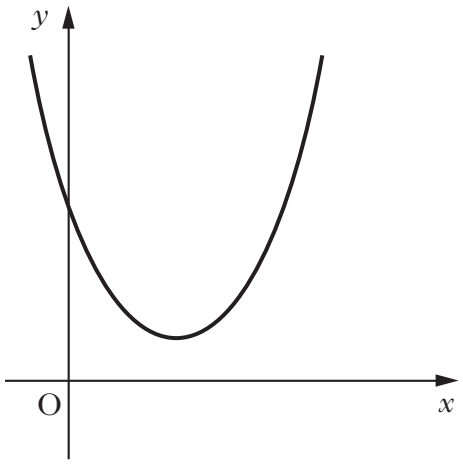
A (3, 2, –11)

B (3, 4, –11)

C (9, 2, –7)

D (9, 4, –7)

13. The diagram shows a curve with equation of the form $y = ax^2 + bx + c$.



Here are two statements about a, b and c:

(1) $a > 0$

(2) $b^2 - 4ac > 0$

Which of the following is true?

A Neither statement is correct.

B Only statement (1) is correct.

C Only statement (2) is correct.

D Both statements are correct.

14. If $\cos x = -\frac{2}{5}$, what is the value of $\cos 2x$?

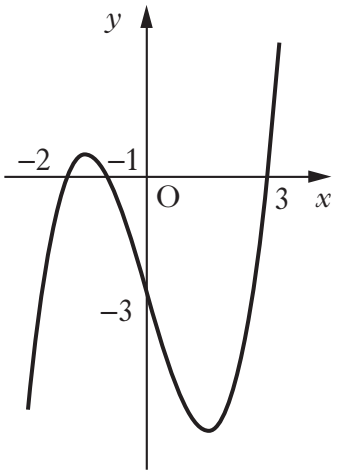
A $\frac{33}{25}$

B $\frac{17}{25}$

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

D $-\frac{17}{25}$

15. The graph of a cubic function, $y = f(x)$, is shown below.
It passes through the points (–2, 0), (–1, 0), (3, 0) and (0, –3).



What is the equation of this curve?

A $y = \frac{1}{2}(x - 3)(x + 1)(x + 2)$

B $y = 2(x - 3)(x + 1)(x + 2)$

C $y = -\frac{1}{2}(x + 3)(x - 1)(x - 2)$

D $y = -2(x + 3)(x - 1)(x - 2)$

[Turn over

16. If $e^{4t} = 6$, find an expression for t.

A $t = \log_e \frac{3}{2}$

B $t = \frac{\log_e 6}{4}$

C $t = \frac{6}{\log_e 4}$

D $t = \frac{\log_e 6}{\log_e 4}$

17. Vectors **u** and **v** have components $\begin{pmatrix} \frac{3}{5} \\ 0 \\ t \end{pmatrix}$ and $\begin{pmatrix} -6 \\ 0 \\ -10 \end{pmatrix}$ respectively.

Here are two statements about **u** and **v**:

(1) when $t = \frac{4}{5}$, **u** is a unit vector

(2) when $t = 1$, **u** and **v** are parallel

Which of the following is true?

A Neither statement is correct.

B Only statement (1) is correct.

C Only statement (2) is correct.

D Both statements are correct.

18. The circle with equation $x^2 + y^2 - 12x - 10y + k = 0$ meets the coordinate axes at exactly three points.

What is the value of k?

A 5

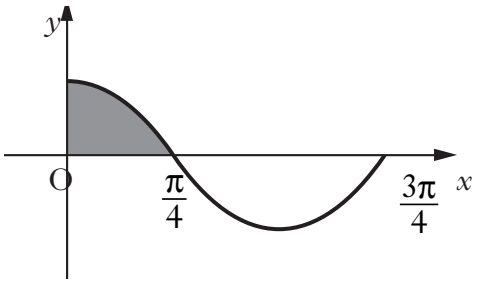
B 6

C 25

D 36

19. The diagram shows part of the graph of $y = a\cos bx$.

The shaded area is $\frac{1}{2}$ unit^2.



What is the value of $\int_0^{\frac{3\pi}{4}} (a\cos bx)\, dx$?

A -1

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

C $\frac{1}{2}$

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

20. The only stationary point on the graph of $y = f(x)$ is the point (a, b).

What are the coordinates of the only stationary point on the graph of $y = -f(2x)$?

A $\left(\frac{1}{2}a, -b\right)$

B $(2a, -b)$

C $\left(-\frac{1}{2}a, b\right)$

D $(-2a, b)$

[*END OF SECTION A*]

[Turn over

2015 Answers

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

Summary		
	A	3
	B	6
	C	6
	D	5