Mathematics Higher Paper 1 Practice Paper S

Time allowed 1 hour 30 minutes NATIONAL QUALIFICATIONS

Read carefully

Calculators may <u>NOT</u> be used in this paper.

Section A – Questions 1 – 20 (40 marks)

Section B (30 marks).

- 1. Full credit will be given only where the solution contains appropriate working.
- 2. Answers obtained by readings from scale drawings will not receive any credit.

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 : $a \cdot b = |a| |b| \cos \theta$, where θ is the angle between *a* and *b*.

or
$$\boldsymbol{a} \cdot \boldsymbol{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$$
, where $\boldsymbol{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$.

Trigonometric formulae:
$$sin(A \pm B) = sin A cos B \pm cos A sin B$$

 $cos(A \pm B) = cos A cos B \mp sin A sin B$
 $sin 2A = 2 sin A cos A$
 $cos 2A = cos^2 A - sin^2 A$
 $= 2 cos^2 A - 1$
 $= 1 - 2 sin^2 A$

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 | $\frac{1}{a}\sin ax + C$ |

SECTION A

ALL questions should be attempted.

- 1. If f(x) = (3x+1)(x-4), find f'(x).
 - A 3
 - B 6*x*-11
 - C $6x^2 4$
 - D $2x^3 4x$
- 2. Vectors p is given by 3i + j k and q is i + 2j + 2k.

What are the components of 2p-q?



3. A circle has equation $x^2 + y^2 + 2x + 8y - 2 = 0$. What is the radius of this circle?

- A $\sqrt{2}$
- B $\sqrt{8}$
- C √19
- D $\sqrt{70}$

- 4. The line with equation kx 4y + 1 = 0 is parallel to the line with gradient 3. What is the value of *k*?
 - A -3B $-\frac{1}{3}$ C $\frac{1}{4}$
 - D 12

5. What is the derivative of $\frac{2+6x^2}{2x}$, with respect to *x*?

- A $3-x^{-2}$
- B $12 4x^{-2}$
- C 6*x*
- D 6

6. Find
$$\int \sqrt[5]{x^2} dx.$$

A $\frac{2}{5}x^{\frac{3}{5}} + c$
B $\frac{5}{7}x^{\frac{7}{5}} + c$
C $\frac{2}{7}x^{\frac{3}{2}} + c$
D $\frac{5}{2}x^{\frac{7}{2}} + c$

7. A circle centre (3, 5) passes through the point (-1, 4).

What is the equation of the circle?

- A $(x-3)^2 + (y-5)^2 = 17$
- B $(x-3)^2 + (y-5)^2 = 85$
- C $(x+3)^2 + (y+5)^2 = 17$
- D $(x+3)^2 + (y+5)^2 = 85$
- 8. What is the value of $\sin \frac{2\pi}{3} + \cos \frac{11\pi}{6}$?
 - A 0
 - B 1
 - $C \sqrt{2}$
 - D $\sqrt{3}$
- 9. Which of the following describes the stationary point on the curve with equation $y = 4 (x-9)^2$?
 - A minimum at (9, 4)
 - B maximum at (9, 4)
 - C minimum at (-9, 4)
 - D maximum at (-9, 4)
- 10. Here are two statements about the equation

$$5x^2 - 3x - 1 = 0$$

- (1) The roots are unequal;
- (2) The roots are irrational.

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.

- 11. What is the minimum value of $11 + 3\cos\left(2x \frac{\pi}{6}\right)$?
 - A 0
 - B 3
 - C 7
 - D 8

12. If
$$y = 5\sin(7-2x)$$
, find $\frac{dy}{dx}$.

- A $-10\cos(7-2x)$
- B $35\cos(7-2x)$
- C $-12\sin(7-2x)$

D
$$10\sin(7-2x)$$

- 13. Find the radius of the circle with equation $x^2 + y^2 = 8x + 3$.
 - $\begin{array}{ll} A & \sqrt{5} \\ B & \sqrt{11} \\ C & \sqrt{19} \end{array}$
 - D $\sqrt{61}$

14.
$$g(x) = \frac{1}{25 - x^2}$$
.

For what value(s) of x is g(x) undefined?

- A –25 and 25
- B –5 and 5
- C $-\frac{1}{5}$ and $\frac{1}{5}$

0

D

15. The diagram shows part of the graph of the cubic y = f(x).



There are three roots at x = -4, x = -2 and x = m as shown. There are two stationary points lying between the roots.

Which diagram shows a sketch of y = f'(x)?







D



- 16. The equation of the parabola shown ^y∧ y = k(x-2)(x-5)is of the form y = k(x-2)(x-5). (4,4) What is the value of *k*? \rightarrow_{x} 0 2 А 2 5 1 В С -1 D –2 What is the maximum value of y = 2 - (3x+1)(3x-1)? 17.
 - A 0
 - B 1
 - C 2
 - D 3

18. Given that $a \cdot b = 5$ and $a \cdot (a+b) = 54$, find |a|.

- A 7 B 9
- D
- C 10.8
- D 270

19. If $\log_6 y = 2\log_6 x + \log_6 12$ express y in terms of x.

- A y = 2x + 12
- B $y = 12x^2$
- C $y = x^2 + 12$
- D $y = 12 \times 2^x$

20. Which diagram below shows the graph of $y = \log_5\left(\frac{1}{x}\right)$?



End of Section A

SECTION B

ALL questions should be attempted.

Marks

5

4

21. (a) (i) Show that
$$(x+1)$$
 is a factor of $f(x) = 2x^3 + 3x^2 - 5x - 6$.

(ii) Hence factorise f(x) fully.

(b) Given that
$$\int_{0}^{p} (6x^{2} + 6x - 5) dx = 6, p > 0, \text{ find the value of } p.$$
 5

22. (a) Write
$$x^2 - 6x + 13$$
 in the form $(x + a)^2 + b$. **2**

(b) (i) Sketch the graph of
$$y = x^2 - 6x + 13$$
.

(ii) State the range of values of *y*. 4

(c) Write down the maximum value of
$$\frac{1}{x^2 - 6x + 13}$$
. 1

23. The diagram shows part of the curve with equation $y = \log_{h}(x + a)$.



The curve passes through the points P(-4, 0) and Q(4, 2). Find the values of *a* and *b*.

24. (a) Write
$$\cos^2 x$$
 in terms of $\cos 2x$.
 1

 (b) Find $\int 4\cos^2 x \, dx$.
 3

Marks



Find p.(p+q+r)

5

End of question paper