Mathematics Higher Paper 2 Practice Paper Q Time allowed 1 hour 10 minutes NATIONAL QUALIFICATIONS

Read carefully

- 1 Calculators may be used in this paper.
- 2 Full credit will be given only where the solution contains appropriate working.
- 3 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	$\frac{1}{a}\sin ax + C$



Calculate the size of angle ACB.

Č(5, 3, 2)

7

4. Part of the graphs of $y = 3 - x - x^2$ and $y = 5 - 2x^2$ are shown opposite.

The curves intersect at the points S and T.



- (*a*) Find the coordinates of S and T.
- (*b*) Find the shaded area enclosed between the two curves.

5

4

5. A circle with centre C_1 has

equation $x^2 + y^2 - 2x - 6y - 15 = 0$.

(*a*) Write down the coordinates of the centre and calculate the length of the radius of this circle.



 C_1 lies on the circumference of this second circle.

A second circle with centre C_2

has a diameter twice that of the

circle with centre C_1 .

The line joining C_1 and C_2 is parallel to the *x*-axis.

(b) Find the equation of the circle with centre C_2 .

6. A manufacturer of executive desks estimates that the weekly cost, in £, of making x desks is given by $C(x) = x^3 - 6x^2 + 560x + 800$.

Each executive desk sells for £2000.

(*a*) Show that the weekly profit made from making *x* desks is given by

$$P(x) = -x^3 + 6x^2 + 1440x - 800$$

- (*b*) (i) How many desks would the manufacturer have to make each week in order to maximise his profit?
 - (ii) What would his annual profit be?
- 7. The number of bacteria, *b*, in a culture after *t* hours is given by $b = b_0 e^{kt}$ where b_0 is the original number of bacteria present.
 - (*a*) The number of bacteria in a culture increases from 800 to 2400 in 2 hours.
 Find the value of *k* correct to 3 significant figures.
 - (*b*) How many bacteria, to the nearest hundred, are present after a further 4 hours?
- 8. (a) Express $2\cos x^\circ 5\sin x^\circ$ in the form $k\cos(x+a)^\circ$, where k > 0 and 0 < a < 90. 4
 - (*b*) (i) Hence write $2\cos 2x^\circ 5\sin 2x^\circ$ in the form $R\cos(2x+b)^\circ$, where R > 0 and 0 < b < 90.
 - (ii) Solve $2\cos 2x^\circ 5\sin 2x^\circ = 5$ in the interval $0 \le x < 360$.

End of Question Paper



3

8

3

2

4