



Mathematics
Higher
Paper 2
February 2011

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:

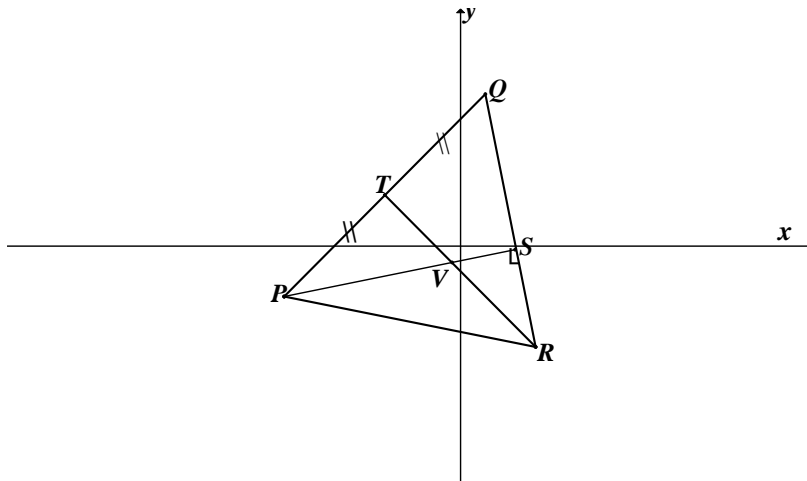
The equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle centre $(-g, -f)$ and radius $\sqrt{g^2 + f^2 - c}$.

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

Trigonometric formulae:

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

1.

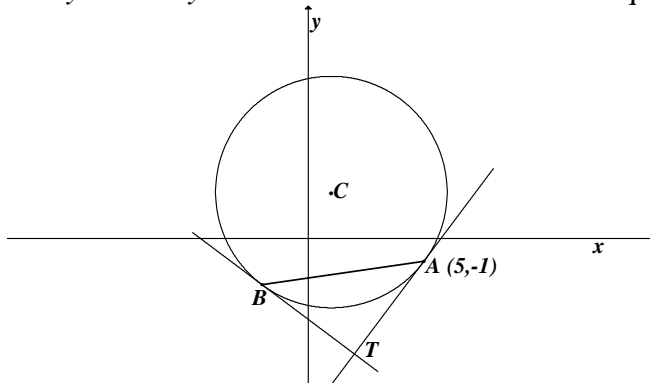


In the diagram, P is the point $(-7, -2)$, Q is $(1, 6)$ and R is $(3, -4)$.
The altitude PS and the median RT intersect at point V.

- Find the equation of the altitude PS (3)
- Find the equation of the median RT (3)
- Find the coordinates of V, the point where PS and RT meet. (3)

- Find the stationary points of the curve $y = 2 + 3x^2 - x^3$ and determine their nature. (8)

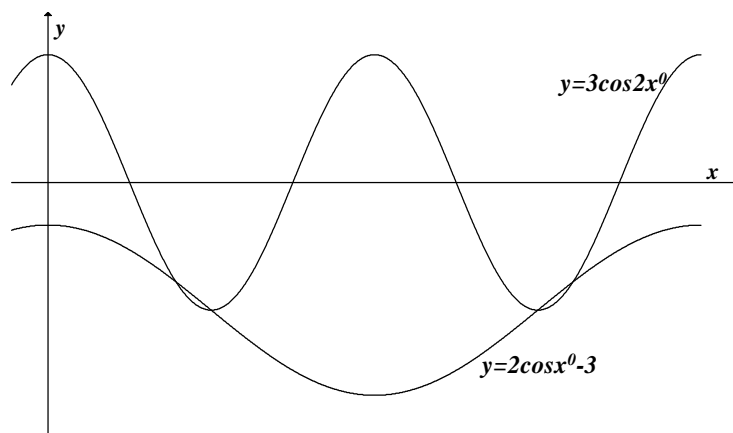
- The diagram shows the circle with equation $x^2 + y^2 - 2x - 4y - 20 = 0$ and the chord AB with equation $x = 7y + 12$.



- The chord meets the circle at points A(5, -1) and B.
Find the coordinates of B. (5)
- Find the equation of the tangent to the circle through the point A. (4)
- The equation of the tangent through B is given by $y + 2 = \frac{-3}{4}(x + 2)$

The two tangents meet at point T. C is the centre of the circle. Calculate the distance between C and T. (4)

4. The two graphs shown intersect at four points, $0 \leq x \leq 360$.

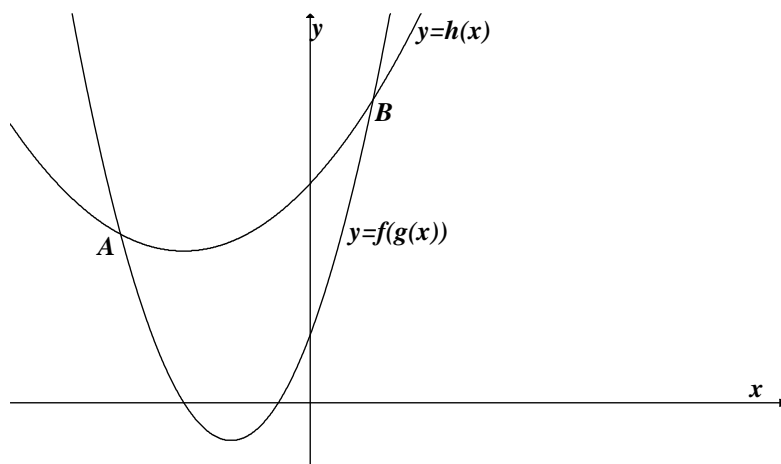


- (a) Find the x coordinates of the points of intersection. (5)
- (b) Hence solve $3\cos 2x^\circ > 2\cos x^\circ - 3$ for $0 \leq x \leq 360$. (1)
5. For what value of p is the line $y=3x+p$ a tangent to the curve $y=x^2-5x+2$? (4)

6. Functions f and g are defined on suitable domains by
 $f(x)=x^2+3x$ and $g(x) = 2x+1$

(a) Show that $f(g(x)) = 4x^2+10x+4$ (2)

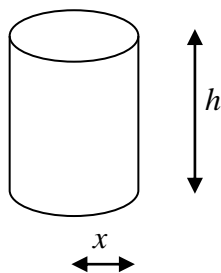
The function $h(x) = x^2+4x+13$ intersects $f(g(x))$ at points A and B as shown in the diagram below.



- (b) (i) Find the coordinates of A and B (4)
(ii) Find the area enclosed by the curves $y=h(x)$ and $y=f(g(x))$ (5)

7. (a) A drinks manufacturer is producing a new can of health drink, packaged in a cylinder. The volume of the can is 330ml. If the radius of the base of the can is x cm, show that the total surface area of the can may be expressed as

$$A(x) = 2\pi x^2 + \frac{660}{x} \quad (3)$$



- (b) Calculate the value of x which gives the minimum possible surface area, and state this area to the nearest cm^2 . (6)

End of question paper