TEST PAPER I

1. If $x^3 + 4x^2 + x - t$ is divisible by $(x + 2)$, find t and fully factorise the function.

2. If $\tan A = K$, prove that the exact value of $\cos 2A = \dfrac{1 - K^2}{1 + K^2}$
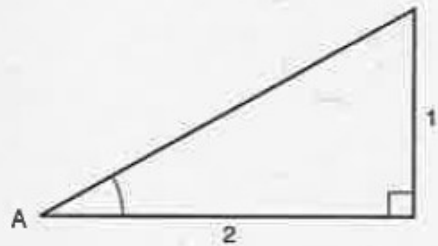
3. A circle has equation $x^2 + y^2 - 6x + 8y = 0$.

   (a) State the centre and radius of the circle.

   (b) Find the equation of the circle under reflection in the y-axis.

4. Solve for x: $\dfrac{2 + x}{2} - (2 - x) < 5$.

5. Find $f'\left(\dfrac{\pi}{6}\right)$ if $f(x) = 3 \sin 2x$.

6. In a right-angled triangle $\tan A = \dfrac{1}{2}$, show that $\cos A$ can be expressed in the form $p\sqrt{5}$ and state the exact value of p.

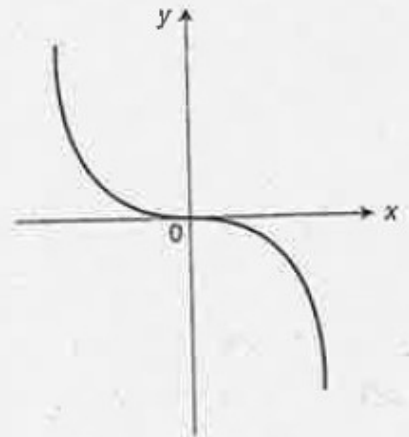7. When $f(x) = (2x + \sqrt{x})^3$, find $f'(x)$ and $f'(4)$.

8. Find all the roots of the equation

   $$x(x + 2)(x^2 - 3)(x^2 + 1)(x^2 - 4), x \in R.$$

   State the answer in a solution set.

9. If $h(x) = g(f(x))$, find $h(x)$ when $f(x) = 2x - 1$ and $g(x) = -x^2 + x + 2$.

10. The diagram shows the sketch of the function $f(x)$. Make a rough sketch of $-f(x)$ and $f(x) - 2$ (on two different sketches).

11. Given $A = (-2, 3, 4)$, $B = (-1, 5, 2)$ and $C = (0, 1, 5)$, show that the cosine of angle $BAC = \dfrac{-4}{9}$ and comment on the type of angle.

12. (a) Using the method of completing the square, find the minimum value of $y = 3x^2 - 6x + 5$.

    (b) Make a rough sketch of the curve showing the turning point and any axis intercepts.

    (c) From your sketch, state the nature of the roots of the equation, giving an explanation.