Oakwood Park Grammar School
YEAR 12 FURTHER MATHEMATICS
INITIAL ASSESSMENT SAMPLE TEST

Name__________________

Teacher______________

Answer these questions on the sheet**.** You must keep this assignment in your maths ring binder.
Calculators are **NOT** allowed. **ALL** workings should be shown to gain full credit.
There are **12** questions worth a total of **60** marks. You have **1 hour** to complete the test.

1.
Figure 1 shows a sketch of triangle ABC with $AB = (x + 2)$ cm, $BC = (3x + 10)$ cm, $AC = 7x$ cm, angle $BAC = 60°$ and angle $ACB = \theta°$

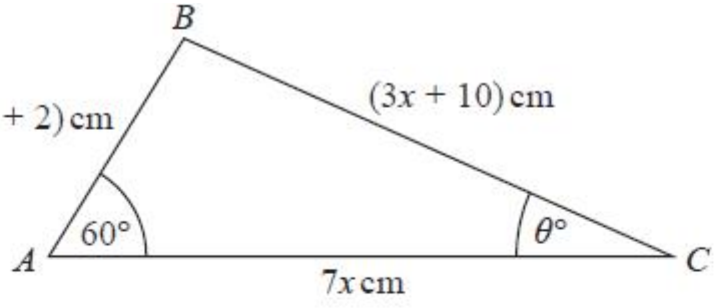

Figure 1

(a) (i) Show that $17x^2 – 35x – 48 = 0$

(3)

(ii) Hence find the value of x.

(1)

(b) Hence show that $sin\theta = k\sqrt{3}$, where k is rational.

(2)

(Total 6 marks)

2.
A curve has equation

$$y = \frac{2}{3}x^3 - \frac{7}{2}x^2 - 4x + 5$$

(a) Find $\frac{dy}{dx}$ writing your answer in simplest form.

(2)

(b) Hence find the range of values of x for which y is decreasing.

(4)

(Total 6 marks)

3.
A curve has equation

$$y = 2x^3 - 4x + 5$$

Find the equation of the tangent to the curve at the point $P(2, 13)$.

Write your answer in the form $y = mx + c$, where m and c are integers to be found.

(Total 5 marks)

4.
Find

$$\int \frac{3x^4 - 4}{2x^3}\, dx$$

writing your answer in simplest form.

(Total 4 marks)

5.
Given that $y = x^2$, use differentiation from first principles to show that $\frac{dy}{dx} = 2x$

(Total 3 marks)

6.
The curve with equation

$$y = x^2 - 32\sqrt{(x)} + 20, \quad x > 0$$

has a stationary point P.

Use calculus

(a) to find the coordinates of P,

(6)

(b) to determine the nature of the stationary point P.

(3)

(Total 9 marks)

7.
The finite region R, shown shaded in Figure 2, is bounded by the curve with equation $y = 4x^2 + 3$, the y-axis and the line with equation $y = 23$

Show that the exact area of R is $k\sqrt{5}$ where k is a rational constant to be found.

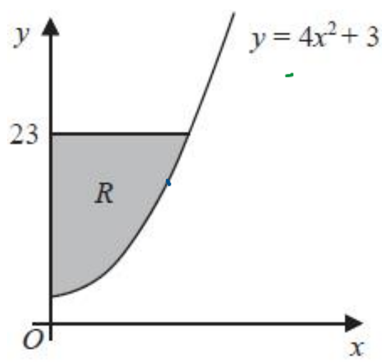

Figure 2

(Total 5 marks)

8. The gradient of a curve C is given by

$$\frac{dy}{dx} = \frac{(x^2+3)^2}{x^2}, \quad x \neq 0.$$

(a) Show that $\frac{dy}{dx} = x^2 + 6 + 9x^{-2}$

(2)

The point (3, 20) lies on C.

(b) Find an equation for the curve C in the form $y = f(x)$.

(6)

(Total 8 marks)

9.

Solve, for $360° \leq x < 540°$,

$$2\sin^2 x + 3\cos x - 3 = 0$$

(Total 5 marks)

10.
Figure 3 shows part of the curve with equation $y = 3 \cos x°$.

The point $P(c, d)$ is a minimum point on the curve with c being the smallest negative value of x at which a minimum occurs.

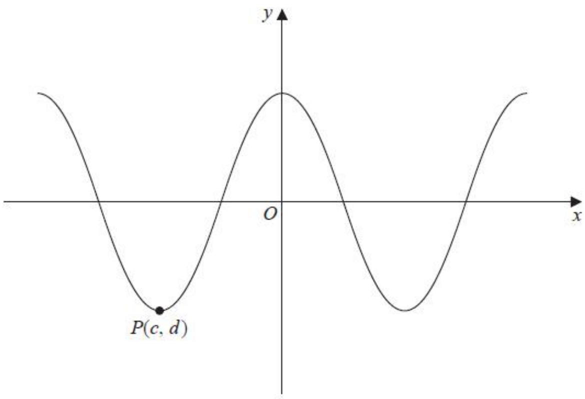

Figure 3

(a) State the value of c and the value of d.

(2)

(b) State the coordinates of the point to which P is mapped by the transformation which

transforms the curve with equation $y = 3 \cos x°$ to the curve with equation

(i) $y = 3\cos\left(\frac{x}{4}\right)$

(ii) $y = 3 \cos (x - 36)°$

(2)

(c) Show that

$$3 \cos \theta = 8 \tan \theta$$

can be written as

$$3 \sin^2 x + 8sin\theta - 3 = 0$$

(2)

(d) Show that, for $450° \leq \theta < 720°$, there is only one value of θ that satisfies the equation. You must provide reasons for your answer.

$$3 \cos \theta = 8 \tan \theta$$

,

(3)

(Total 9 marks)

SCORE (60)	PERCENTAGE