MATHEMATICAL FORMULAE

For Examiner's use
23

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + ... + \binom{n}{r}a^{n-r}b^r + ... + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!} = \frac{n(n-1).....(n-r+1)}{r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$$

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

1 It is thought that the selling price of a used car, \$$P$, and the age of that car, m months, can be modelled by $P = a\ln m + b$. When values of P are plotted against $\ln m$, a straight line is obtained. It is given that $P = 112\,000$ when $m = 11$ and that $P = 47\,500$ when $m = 75$. Find

(i) the values of a and of b, [3]

(ii) the value of m when $P = 90\,000$. [2]

2 Recorded values of yield of corn, y kg/acre, and amount of fertiliser applied, x kg/acre, are shown in the table below.

x (kg/acre)	40	80	120	160	200
y (kg/acre)	100	111	119	126	132

It is known that the y and x are related by the equation $y = a\sqrt{x} + b$, where a and b are constants.

(i) On graph paper, plot y against $\sqrt{x}$ and draw a straight line graph. The vertical y-axis should start at 70 and have a scale of 2 cm to 10. The horizontal $\sqrt{x}$-axis should start at 0 and have a scale of 2 cm to 2. [3]

Use your graph to estimate

(ii) the yield of corn when no fertiliser is used, [1]

(iii) the value of a. [2]

(iv) the expected yield when 100 kg/acre of fertiliser is applied. [2]

3 Given that $\mathrm{f}(x) = \dfrac{3(3-4x)^2}{2\sqrt{3-4x}}$, find $\mathrm{f}'(x)$. [3]

4 Find the derivative of the curve $y = (2x+3)(x-3)^4$. [3]

5 Given that $y = \dfrac{3x^2}{\sqrt{4x-3}}$, express $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ in the form $\dfrac{hx(x-m)}{\sqrt{(4x-3)^3}}$, where h and m are constants. [4]

End of Paper