THE MEANINGS OF INSTRUCTIONS OFTEN USED IN EXAMINATION QUESTIONS

1. Write down

The answer should be obvious and no calculation needed.

e.g. Write down the integral which should be calculated in order to find the area of the region between the curve and the x-axis.

e.g. The roots of the cubic equation

$$x^3 - 5x^2 - 6x + 1 = 0$$

are α, β and γ.

Write down the values of $\alpha + \beta + \gamma$, $\alpha\beta + \beta\gamma + \gamma\alpha$ and $\alpha\beta\gamma$.

2. State

The answer is probably straightforward – if you understand what is being asked – with little or no work required.

e.g. State the condition under which the quadratic equation $z^2 + pz + q = 0$ does not have real roots, where p and q are real numbers.

3. Find

The answer is probably not quite obvious and some work will be needed before you can give it. Any intermediate steps in your argument should be written down and included in your answer.

e.g. Find the coordinates of the points of intersection of the line $y = 2x$ with the curve $y = x^2 - 3x$.

4. Determine

Find precisely or define. "Determine" is a rather stronger word than "Find".

e.g. Show that $x^2 + 4x + 7 = (x + 2)^2 + a$ where a is to be determined.

e.g. Use the method of dimensions to determine the values of α, β and γ.

5. Obtain

The word "Obtain" is used in much the same circumstances as "Determine". It is somewhat stronger than "Find", implying that a degree of rigour is expected.

e.g. Obtain an expression for $\sum_{r=1}^{n} u_r$ where $u_r = 2^r + 4r$.

e.g. Obtain the probability generating function (pgf) of the random variable X.

6. Calculate

Some calculations (i.e. involving numbers) will be required and the answer will be a number, usually given as a fraction or decimal.

e.g. Given that $y = x^3 - x + 6$ and P is $(-1, 6)$, calculate the value of $\frac{dy}{dx}$ at P.

7. Evaluate

Substitution in a formula or expression will be required, possibly after some initial work. Answers may be given in terms of functions such as ln2 or $\sin\frac{\pi}{10}$.

e.g. Evaluate the integral

$$\int_0^1 x\sqrt{1+x^2}\,dx$$

8. Show that

You are given a result and have to show that it is true. Because you are given the answer, the explanation has to be detailed and cover every step.

e.g. Show that the curve $y = x\ln x$ has a stationary point $\left(\frac{1}{e}, -\frac{1}{e}\right)$.

9. Explain

This is usually used when you are given a result and have to explain or interpret the reasoning behind it. As with "Show", the explanation has to be detailed and precise because you are given the answer.

e.g. Explain how, by using logarithms, the curve given by plotting y against x can be transformed into a straight line.

10. Prove

The use of the word "Prove" rather than "Show" indicates that a more formal statement of the argument is required, with careful logical justification for each step. It is usually used for general results.

e.g. Given that $u_n = 2u_{n-1} + 8 - 4n$ for $n \geqslant 2$; $u_1 = 6$, prove, by induction or otherwise, that $u_n = 2^n + 4n$ for all positive integers n.

11. Deduce, Derive

These terms have the same meaning as "Prove" but are usually used in cases where the result is more limited (e.g. a special case) or the starting point is part of the way through a full proof. A rigorous argument is still required.

e.g. Deduce that if $y = mx + c$ is a tangent to the ellipse, then $c^2 = a^2m^2 + b^2$.

12. Verify

This term is often used when you are required to show that a given result fits an equation. "Verify" differs from "Show" in that you are allowed, and probably expected, to use the given result in your argument.

e.g. Verify that the tangent at Q passes through the point R (–4, –1). (The tangent at Q was $y = x + 3$.)

e.g. Verify that the differential equation

$$\frac{dy}{dx} = x + y$$

is satisfied by the family of curves

$$y = Ce^x - x - 1.$$

In the case of a differential equation, if you are given initial conditions, they need to be checked as well, as part of the verification.

13. Hence

The next step must be based on what has gone before. Alternative methods should not be used.

e.g. You are given that $f(x) = 2x^3 - x^2 - 7x + 6$. Show that $f(1) = 0$. Hence find the three factors of $f(x)$.

14. Hence or otherwise

The next step may be based on what has gone before, but alternative methods are available and acceptable. If you choose "Hence", you may well already be some way towards the answer. The examiner will never suggest "Hence" if it is a poor method, but it may not be your preferred method.

e.g. Show that $(\cos x + \sin x)^2 = 1 + \sin 2x$ for all x.
Hence, or otherwise, find the derivative of $(\cos x + \sin x)^2$.

15. Expression

When one variable is written, algebraically, in terms of others, this is called an expression.

e.g. The first four terms in an infinite geometric series are 54, 18, 6, 2.
Write down an expression for the n^{th} term of the series.

16. Formula

An expression for something. A formula is likely to be well known because it is often used, like that for the roots of a quadratic equation.

17. Express

Write in the form of an expression

e.g. Express $2\cos x - 5\sin x$ in the form $r\cos(x + \alpha)$.

18. Plot

Mark points accurately, preferably on graph paper. You will either have been given the points or have had to calculate them. You will often then join them with a curve or a straight line, or draw a line of best fit through them.

e.g. Complete the table on the insert for $\log_{10} y$. Plot the points $(x, \log_{10} y)$ on the graph.

19. Sketch

Draw a diagram, not necessarily to scale and usually not on graph paper, showing the main features of a curve.

- Turning points
- Asymptotes
- Intersection with the y-axis
- Intersection with the x-axis
- Behaviour for large x (+ or –)

e.g. Sketch the curve with equation $y = \sin x$.

20. Draw

Draw to an accuracy appropriate to the problem. You are being asked to make a sensible judgement about this.

e.g. Complete the table of values of $\log_{10} y$ on the insert, and draw the graph of $\log_{10} x$ against $\log_{10} y$.

21. Exact

An exact answer is one where numbers are not given in rounded form. The answer will often contain an irrational number such as $\sqrt{3}$, e or π and these numbers should be given in that form. Do not use your calculator when you see the word "exact".

The use of the word exact also tells you that rigorous (exact) working is expected in your answer to the question.

e.g. Find the exact solution of $\ln x = 2$
The correct answer is e^2 and **not** 7.389056.

GREEK LETTERS

Lower Case	Upper Case	Name	English equivalent
α	A	alpha	a
β	B	beta	b
γ	Γ	gamma	g
δ	Δ	delta	d
ε	E	epsilon	e
ζ	Z	zeta	z
η	H	eta	e
θ	Θ	theta	th
ι	I	iota	i
κ	K	kappa	k
λ	Λ	lambda	l
μ	M	mu	m
ν	N	nu	n
ξ	Ξ	xi	x
o	O	omicron	o
π	Π	pi	p
ρ	P	rho	r
σ	Σ	sigma	s
τ	T	tau	t
υ	Y	upsilon	u
φ	Φ	phi	ph
χ	X	chi	ch
ψ	Ψ	psi	ps
ω	Ω	omega	o