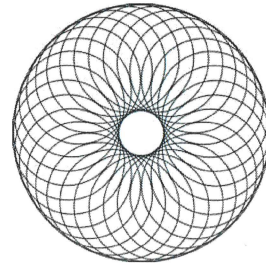


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**A LEVEL MATHS
YEAR 1 PURE**



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- (1) Indices
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- (11) Applications of Quadratics Equations
- (12) Solving Linear Simultaneous Equations
- (13) Linear & Non-Linear Simultaneous Equations
- (14) Graphing Simultaneous Equations
- (15) Linear Inequalities
- (16) Quadratic Inequalities
- (17) Graphing Inequalities
- (18) Shading Inequalities
- (19) Cubic Graphs
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- (22) The Intersection of Graphs
- (23) Transforming Graphs (Translations)
- (24) Transforming Graphs (Stretching/Reflecting)
- (25) Straight Line Graphs in the form $y = mx + c$
- (26) More Straight Line Graphs
- (27) Straight Line Graphs (Parallel & Perpendicular)
- (28) The Geometry of Straight Lines
- (29) The Application of Linear Graphs
- (30) Circle Geometry Midpoint & Perpendicular

- (31) The Equation of a Circle
- (32) Circles and Straight Lines (Intersections)
- (33) Circles (Tangents and Chords)
- (34) Circles and Triangles
- (35) Algebraic Fractions
- (36) Polynomial Division
- (37) The Factor and Remainder Theorem
- (38) An Introduction to Mathematical Proof
- (39) Methods of Proof
- (40) Binomial Expansion (Using Pascal's Triangle)
- (41) Binomial Expansion (Factorial Notation)
- (42) Binomial Expansion (The $\binom{n}{r}$ Method)
- (43) Binomial Expansion (Problem Solving)
- (44) Binomial Expansion (Estimations and Approximations)
- (45) The Cosine Rule
- (46) The Sine Rule
- (47) Areas of a Triangles
- (48) Triangles (Problem Solving)
- (49) Sine, Cosine & Tangent Graphs
- (50) Transforming Graphs (Trigonometry)
- (51) The 'CAST' Diagram for Trig Ratios
- (52) Trigonometry (Exact Values)
- (53) Proving Trigonometric Identities
- (54) Solving Basic Trigonometric Equations
- (55) More Challenging Trigonometric Equations
- (56) Using Identities to Solve Trig Equations
- (57) Vectors (Introduction)

- (58) Vector Notation (Column and i and j form)
- (59) Vectors (Magnitude and Direction)
- (60) Vectors (Position and Direction Vectors)
- (61) Vector Geometry
- (62) Application of Vectors
- (63) Differentiation (Gradients of Curves)
- (64) Differentiation from 1st Principles
- (65) Differentiating x^n (Basic Powers of)
- (66) Differentiation (Quadratic Expression)
- (67) Differentiation (Multiple Terms)
- (68) Differentiation (Gradients, Tangents and Normals)
- (69) Differentiation (Increasing and Decreasing Functions)
- (70) Differentiation (Stationary Points)
- (71) Differentiation (Gradient Functions)
- (72) The Applications of Differentiation
- (73) Integration (Basic Expressions (x^n))
- (74) Indefinite Integrals
- (75) Integration (Finding c and Finding Functions)
- (76) Integration (Definite Integrals)
- (77) Integration (Basic Areas Under Curves)
- (78) Integration ('Negative and Positive Areas')
- (79) Integration (Areas between Curves and Lines)
- (80) Basic Exponential Functions
- (81) 'The' Exponential Function $y = e^x$
- (82) Applications of Basic Exponential Models
- (83) Logarithms (Simplifying & Evaluating)
- (84) Logarithms (The Log Laws)
- (85) Logarithms (Log and Exponential Equations)

① Index Laws

XBI Pure

① $72p^{5/6}$

② $2x^3 - xy$

③ $\frac{1}{8^{1/3}} = \frac{1}{2}$

E/D

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① $\frac{2x^5}{6x} + \frac{12x^{1/5}}{6x}$

$\frac{1}{3}x^4 + 2x^{-4/5}$ o.e

② $(5^2)^{3-x} = (5^3)^{2x+1}$

$5^{6-2x} = 5^{3x+3}$

$\therefore 6-2x = 3x+3$

$3 = 5x$

$3/5 = x$

③ $\left(\frac{16}{16} + \frac{9}{16}\right)^{-1/2}$

$\left(\frac{25}{16}\right)^{-1/2}$

$\left(\frac{16}{25}\right)^{1/2}$

$\frac{4}{5}$

C/B

① $\left(\frac{x^{1/3}}{16x^{1/2}}\right)^{3/4}$

$= \left(\frac{1}{16x^{1/6}}\right)^{3/4}$

$= \left(\frac{1}{2x^{1/16}}\right)^3$

$= \frac{1}{8x^{3/16}}$ or $\frac{1}{8}x^{-3/16}$

② $(9x \times 16x^4)^{1/2}$

$= (144x^5)^{1/2}$

$= 12x^{5/2}$

③ $\frac{8x^{16/15}}{2x^{2/3}}$

$= 4x^{6/15}$

$= 4x^{2/5}$

A/A*

There are some o.e's on here!

You may have the same answer but written a different way!

② Expanding Brackets

$$① (A+B)(A+B) = A^2 + 2AB + B^2$$

$$② A^2 - 2AB + B^2$$

$$③ (x+y)(2x-y+3)$$

$$\equiv 2x^2 - xy + 3x + 2xy - y^2 + 3y$$

$$\equiv 2x^2 + xy - y^2 + 3x + 3y$$

D/E

$$① -2(9-6x+x^2)$$

$$\equiv -18 - 12x - 2x^2$$

$$② (9x^2+6x+1)(3x-1)$$

$$\equiv 27x^3 - 9x^2 + 18x^2 - 6x + 3x - 1$$

$$\equiv 27x^3 + 9x^2 - 3x - 1$$

$$③ (2x+y)(2x+y)(2x+y)$$

$$\equiv (2x+y)[4x^2 + 4xy + y^2]$$

$$\equiv 8x^3 + 8x^2y + 8xy^2$$

$$+ 4x^2y + 4xy^2 + y^3$$

$$\equiv 8x^3 + 12x^2y + 12xy^2 + y^3$$

$$A=8, B=12, C=12$$

* you can use the binomial expansion on this

C/B

$$① (x^{\frac{2}{3}} + x^{\frac{1}{2}})(x^{\frac{2}{3}} + x^{\frac{1}{2}})$$

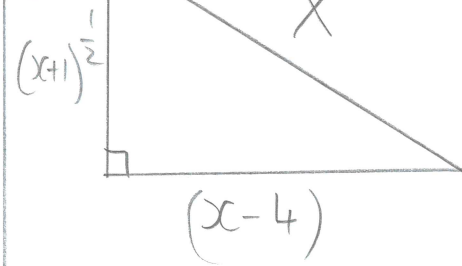
$$\equiv x^{\frac{4}{3}} + 2x^{\frac{7}{6}} + x$$

$$② (x+y)(4x-y)(y-\frac{3}{x})$$

$$y^3 - 12y + 3y$$

$$\equiv y^3 - 9y$$

③



A/A*

$$X^2 = (x-4)^2 + [(x+1)^{\frac{1}{2}}]^2$$

$$X^2 = x^2 - 8x + 16 + x + 1$$

$$X^2 = x^2 - 7x + 17$$

$$X = (x^2 - 7x + 17)^{\frac{1}{2}}$$

$$A=1 \quad B=-7 \quad C=17$$

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③ Factorising

$$\begin{aligned} \textcircled{1} & (12x+16)(12x+3) \\ & \neq (3x+4)(4x+1) \\ & \equiv (3x+4)(4x+1) \end{aligned}$$

N.B don't factor like this if you do it by grouping!

$$\textcircled{2} \text{ D.O.T.O.S} \\ (11x+6)(11x-6)$$

E/D

$$\textcircled{3} (3x+1)^2$$

$$\begin{aligned} \textcircled{1} & (2-x)(3+4x) \text{ C/B} \\ & \text{OR } -(x-2)(3+4x) \end{aligned}$$

$$\begin{aligned} \textcircled{2} & x(20x^2-7x-3) \\ & \equiv x(5x-3)(4x+1) \end{aligned}$$

$$\textcircled{3} (8x^2+5y)(8x^2-5y)$$

$$\textcircled{1} (3x+1)^{30} [(3x+1)-1]$$

$$\begin{aligned} & (3x+1)^{30}(3x) \\ & \text{or} \\ & 3x(3x+1)^{30} \end{aligned}$$

$$\begin{aligned} \textcircled{2} & x(169-x^2y^2) \\ & x(13+xy)(13-xy) \end{aligned}$$

$$\begin{aligned} \textcircled{3} & \equiv (\cos^2 x + \sin^2 x)(\cos^2 x - \sin^2 x) \\ & \equiv 1(\cos^2 x - \sin^2 x) \\ & \equiv \cos^2 x - \sin^2 x \end{aligned}$$

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④ Negative and Fractional Indices

$$\textcircled{1} \left(\frac{36}{25}\right)^{\frac{1}{2}} = \frac{6}{5} \quad \text{E/O}$$

$$\textcircled{2} x^{\frac{1}{4}}$$

$$\textcircled{3} \left(\frac{8}{1}\right)^{\frac{2}{3}} = \left(\frac{2}{1}\right)^2 = 4$$

$$\textcircled{1} x^1 \times x^{\frac{1}{2}} = x^{3/2} \quad \text{C/B}$$

$$\textcircled{2} \sqrt{16x^6} = 4x^3$$

$$\textcircled{3} \frac{x^2}{x^{-8}} = x^{2+8} = x^{10}$$

$$\textcircled{1} \left(\frac{16}{81}\right)^{3/4} \times \left(\frac{1}{x^{1/4}}\right)^{3/4} \quad \text{A/A*}$$

$$\left(\frac{2}{3}\right)^3 \times \frac{1}{x^{3/16}}$$

$$\frac{8}{27x^{3/16}} \quad \text{or} \quad \frac{8}{27} x^{-3/16}$$

$$\textcircled{2} \frac{A^2x^2 - Ax^2 + Ax^2 - B^2}{A^2x^2}$$

$$\frac{A^2x^2 - B^2}{A^2x^2}$$

$$\frac{A^2x^2}{A^2x^2} - \frac{B^2}{A^2x^2}$$

$$1 - \left(\frac{B}{Ax}\right)^2$$

$$\textcircled{3} \left(\frac{27}{M^{12}}\right)^{-\frac{1}{3}}$$

$$\left(\frac{M^{12}}{27}\right)^{\frac{1}{3}}$$

$$\frac{M^4}{3}$$

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S Surds

$$\textcircled{1} (\sqrt{2} + 2\sqrt{2})^2$$

$$(3\sqrt{2})^2$$

$$12$$

E/D

OR

$$(\sqrt{2} + 2\sqrt{2})(\sqrt{2} + 2\sqrt{2}) =$$

$$2 + 4 + 4 + 2 = 12$$

o.e

$$\textcircled{2} \frac{2 \times \sqrt{6}}{3\sqrt{6} \times \sqrt{6}}$$

$$\frac{2\sqrt{6}}{3 \times 6}$$

$$\frac{\sqrt{6}}{9}$$

$$\frac{\sqrt{2} \times 3}{3 \times 3}$$

$$\therefore a = 3$$

$$\textcircled{3} \frac{22(S + \sqrt{3})}{(S - \sqrt{3})(S + \sqrt{3})} =$$

$$\frac{22(S + \sqrt{3})}{25 + 5\sqrt{3} - 5\sqrt{3} - 3} =$$

$$\frac{22(S + \sqrt{3})}{22}$$

$$\therefore S + \sqrt{3} \text{ O.E.D}$$

$$\textcircled{1} \left(\frac{\sqrt{2}}{2} + 5\sqrt{2} - \frac{\sqrt{2}}{2} - 4\sqrt{2} \right)^2$$

$$(5\sqrt{2} - 4\sqrt{2})^2$$

$$(\sqrt{2})^2$$

C/B

$$\textcircled{2} \frac{(\sqrt{6} + 2)(\sqrt{6} + 2)}{(\sqrt{6} - 2)(\sqrt{6} + 2)}$$

$$\frac{(\sqrt{6} + 2)^2}{6 + 2\sqrt{6} - 2\sqrt{6} - 4}$$

$$\frac{(\sqrt{6} + 2)^2}{2} \quad \therefore n = 2$$

$$\textcircled{3} (A + \sqrt{B})(A + \sqrt{B})$$

$$A + \sqrt{A}\sqrt{B} + \sqrt{B}\sqrt{A} + B$$

$$A + 2\sqrt{AB} + B$$

① Using expansion and not binomial!

$$(A + \sqrt{B})(A + 2\sqrt{AB} + B)$$

$$A\sqrt{A} + 2A\sqrt{B} + B\sqrt{A} + \sqrt{B}A$$

$$+ 2\sqrt{AB} + B\sqrt{B} =$$

$$A^{\frac{3}{2}} + 2AB^{\frac{1}{2}} + BA^{\frac{1}{2}} + B^{\frac{3}{2}}$$

$$+ 2A^{\frac{1}{2}}B + B^{\frac{1}{2}}A =$$

$$A^{\frac{3}{2}} + 3AB^{\frac{1}{2}} + 3A^{\frac{1}{2}}B + B^{\frac{3}{2}}$$

$$\textcircled{2} \frac{20}{(2 + \sqrt{2})(6 - \sqrt{2})} = \frac{20}{12 - 2\sqrt{2} + 6\sqrt{2} - 2}$$

$$= \frac{20}{10 + 4\sqrt{2}} = \frac{10}{5 + 2\sqrt{2}}$$

$$= \frac{10(S - 2\sqrt{2})}{(5 + 2\sqrt{2})(5 - 2\sqrt{2})}$$

$$= \frac{10(S - 2\sqrt{2})}{25 - 10\sqrt{2} + 10\sqrt{2} - 8}$$

$$= \frac{10}{17}(S - 2\sqrt{2})$$

$$\therefore A = \frac{10}{17}, B = 5, C = 2$$

$$\textcircled{3} \boxed{21 + 9\sqrt{3}} \sqrt{3} + 3$$

$$\frac{(21 + 9\sqrt{3})(\sqrt{3} - 3)}{(\sqrt{3} + 3)(\sqrt{3} - 3)} =$$

$$\frac{21\sqrt{3} - 63 + 27 - 27\sqrt{3}}{3 - 9} = \frac{-6\sqrt{3} - 36}{-6} = \underline{\underline{6 + \sqrt{3}}}$$

∴ Perimeter =

$$2(6 + \sqrt{3}) + 2(\sqrt{3} + 3)$$

$$12 + 2\sqrt{3} + 2\sqrt{3} + 6$$

$$18 + 4\sqrt{3}$$

$$\therefore A = 4, B = 3, C = 18$$