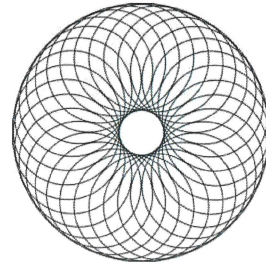


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**A LEVEL MATHS
YEAR 1 PURE**



ANSWERS

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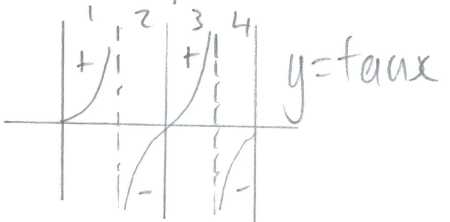
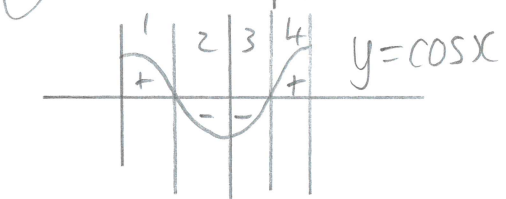
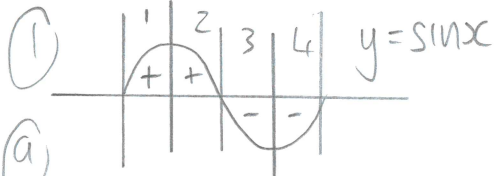
**THESE ANSWERS CANNOT BE UPLOADED TO ANY SOCIAL MEDIA PLATFORM
OR SOLD ON FOR PROFIT. SCHOOLS CAN USE THEM ON THEIR VLE.**

- (1) Indices
- (2) Expanding Brackets
- (3) Factorising Expressions
- (4) More Indices (Negative and Fractional)
- (5) Working with Surds
- (6) Solving Quadratic Equations
- (7) Completing the Square for Quadratics Expressions
- (8) Function Notation
- (9) Sketching Quadratic Graphs
- (10) The Discriminant for Quadratic Equations
- (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
- (20) Quartic Graphs
- (21) Reciprocal Graphs
- (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)

(S1) Angles in all 4 quadrants



④

1st	sin + cos + tan +	2nd	sin + cos - tan -
3rd	sin - cos - tan +	4th	sin - cos + tan -

⑤ 2nd or 3rd.

- ⑥
- (b) 1st, 4th
 - (c) 1st, 3rd
 - (d) 2nd, 3rd
 - (e) 1st, 2nd

- ⑦
- (a) Negative
 - (b) Positive
 - (c) Positive
 - (d) Positive
 - (e) 3rd.

- ⑧
- (a) -sin x
 - (b) cos x
 - (c) -tan x
 - (d) -sin x
 - (e) cos x

52) Exact Values of Trigonometric Ratios

- ① a) $\sqrt{3}$ b) $\frac{\sqrt{2}}{2}$ or $\frac{1}{\sqrt{2}}$ c) $\frac{\sqrt{3}}{2}$
d) $\frac{\sqrt{3}}{2}$ e) 0 f) $\frac{1}{\sqrt{3}}$ or $\frac{\sqrt{3}}{3}$ g) 0
h) -1 i) Undefined j) $\frac{\sqrt{2}}{2}$ or $\frac{1}{\sqrt{2}}$

② Opposite = $\sin(x) \times \text{Hypotenuse}$
 $\therefore y = 0.4 \times 8$
 $y = 3.2$

③ 45° (both $\frac{1}{\sqrt{2}}$ or $\frac{\sqrt{2}}{2}$)

- ① a) $-\frac{1}{\sqrt{3}}$ or $-\frac{\sqrt{3}}{3}$ b) $-\frac{1}{\sqrt{2}}$ or $-\frac{\sqrt{2}}{2}$
c) $\frac{1}{2}$ d) $-\frac{\sqrt{3}}{2}$ e) $-\frac{\sqrt{2}}{2}$ f) $\frac{1}{\sqrt{3}}$ or $\frac{\sqrt{3}}{3}$
g) -1 h) $-\frac{\sqrt{3}}{2}$ i) $-\frac{1}{\sqrt{3}}$ or $-\frac{\sqrt{3}}{3}$
j) $\frac{1}{2}$
② 135° (both $-\frac{1}{\sqrt{2}}$ or $-\frac{\sqrt{2}}{2}$)

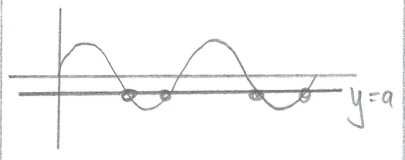
③ $\sqrt{3} + 3\left(-\frac{1}{\sqrt{3}}\right)$

$\sqrt{3} + 3\left(-\frac{\sqrt{3}}{3}\right)$

$\sqrt{3} + -\sqrt{3}$

0

① 4 times



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Steve Blades

(S3) Trigonometric Identities

(1) $\frac{\sin x}{\cos x} \equiv \tan x$

$\sin^2 x + \cos^2 x \equiv 1$

(2) $\tan 6x$

(b) $\sin x$

(c) $\cos 3x$

(d) $\cos^2 x$

(e) 1

(f) $6(1) = 6$

(g) $\tan^2 x$

(h) $\frac{\sin 4\theta}{\cos 4\theta} \equiv \tan 4\theta$

(i) $\frac{\sin x}{\cos x} \times \cos x \equiv \sin x$

(3) $(\sin x + \cos x)(\sin x + \cos x)$
 $\sin^2 x + \sin x \cos x + \sin x \cos x + \cos^2 x$

We know $\sin^2 x + \cos^2 x \equiv 1$

$\therefore 1 + \sin x \cos x + \sin x \cos x$
 $\equiv 1 + 2 \sin x \cos x$ Q.E.D

(1) We know $\cos^2 x + \sin^2 x \equiv 1$

$(\cos^2 x + \sin^2 x)(\cos^2 x - \sin^2 x)$
 $1(\cos^2 x - \sin^2 x)$
 $\cos^2 x - \sin^2 x$ ✓

(2) (a) LHS

Adding fractions

$\frac{\sin^2 e + \cos^2 e}{\sin e \cos e}$

We know $\cos^2 e + \sin^2 e \equiv 1$

$\therefore \frac{1}{\sin e \cos e}$ Q.E.D

(b) We know $\tan A \equiv \frac{\sin A}{\cos A}$

LHS $\frac{3 \sin A}{\sin A}$
 $\frac{3}{\cos A}$

$\frac{3}{\cos A}$

$3 \times \frac{\cos A}{1}$

$3 \cos A$ Q.E.D

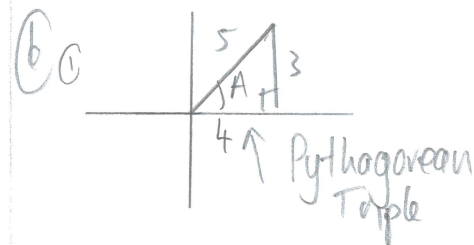
LHS \equiv RHS

(3) (a) We know $\tan x \equiv \frac{\sin x}{\cos x}$

$\therefore \frac{9 \sin x}{\cos x} = 14$

$\frac{\sin x}{\cos x} = \frac{14}{9}$

$\tan x = \frac{14}{9}$



$\cos A = \frac{\text{adj}}{\text{hyp}}$

$\therefore \cos A = \frac{4}{5}$

OR $\cos A = \pm \sqrt{1 - \sin^2 A}$

$\cos A = \pm \sqrt{1 - \frac{9}{25}}$

$\cos A = \pm \sqrt{\frac{16}{25}}$

$\cos A = \pm \frac{4}{5}$

$\cos A = \frac{4}{5}$ as $0 < A < 90$

(6) (i) $\tan A = +\frac{3}{4}$

(1) Pythagorean Triple



(a) $\cos A = -\frac{3}{5}$

(ii) $\tan A = \frac{4}{3}$

You can use the identity $\sqrt{1 - \sin^2 A}$

(b) \cos would be positive and \tan would be negative

(2) (a) We know $\cos^2 e + \sin^2 e \equiv 1$

$x = 4 \cos e$ $y = 2 + 4 \sin e$

$\frac{x}{4} = \cos e$ $\frac{y-2}{4} = \sin e$

$\left(\frac{x}{4}\right)^2 + \left(\frac{y-2}{4}\right)^2 = 1$

$\frac{x^2}{16} + \frac{(y-2)^2}{16} = 1$

$x^2 + (y-2)^2 = 16$

(b) We know $\cos^2 x + \sin^2 x \equiv 1$

$p = 1 - 2 \cos x$

$2 \cos x = 1 - p$

$\cos x = \frac{(1-p)}{2}$

$q = 3 \sin x + 1$
 $q - 1 = 3 \sin x$
 $\frac{(q-1)}{3} = \sin x$

(S3) Continued

2 (6) Continued

$$\left(\frac{1-p}{2}\right)^2 + \left(\frac{q-1}{3}\right)^2 = 1$$

$$\frac{(1-p)^2}{4} + \frac{(q-1)^2}{9} = 1 \quad \times \text{by } 36$$

$$9(1-p)^2 + 4(q-1)^2 = 36$$

$$9(1-2p+p^2) + 4(q^2-2q+1) = 36$$

$$9 - 18p + 9p^2 + 4q^2 - 8q + 4 = 36$$

$$9p^2 - 18p + 4q^2 - 8q + 13 = 36$$

$$9p^2 + 4q^2 - 18p - 8q - 23 = 0$$

3 (a) We know $\sin(90-x) = \cos x$

$\therefore \cos x \tan x$

$$\cos x \left(\frac{\sin x}{\cos x}\right)$$

$\sin x$ Q.E.D. RHS = LHS

(6) We know that $\sin^2 x + \cos^2 x = 1$

$$\frac{(\sin x + \cos x)(\sin x + \cos x)}{\sin x \cos x}$$

$$\frac{\sin^2 x + \sin x \cos x + \cos x \sin x + \cos^2 x}{\sin x \cos x}$$

$$\frac{(\sin^2 x + \cos^2 x) + 2 \sin x \cos x}{\sin x \cos x}$$

$$\frac{1 + 2 \sin x \cos x}{\sin x \cos x}$$

$$\frac{1}{\sin x \cos x} + \frac{2 \sin x \cos x}{\sin x \cos x}$$

$$2 + \frac{1}{\sin x \cos x} \quad \text{Q.E.D. LHS} = \text{RHS}$$

(c) LHS we know $\tan A = \frac{\sin A}{\cos A}$

$$\therefore \frac{\sin A}{\cos A} + \frac{\sin A}{1}$$

$$\frac{\sin A + \cos A \sin A}{1(\cos A)} \quad (\text{common denominator})$$

$\frac{\sin A(1 + \cos A)}{\cos A}$ (factoring) Q.E.D.

$$\frac{(\cos^2 x + \sin^2 x)(\cos^2 x - \sin^2 x)}{(\cos^2 x - \sin^2 x)}$$

We know that $\cos^2 x + \sin^2 x = 1$

$$\therefore \frac{1(\cos^2 x - \sin^2 x)}{(\cos^2 x - \sin^2 x)}$$

1 Q.E.D

(e) We know that $\tan x = \frac{\sin x}{\cos x}$

LHS

$$\sin x \sqrt{1 + \frac{\sin^2 x}{\cos^2 x}}$$

$$\sin x \sqrt{\frac{\cos^2 x + \sin^2 x}{\cos^2 x}}$$

$$\sin x \sqrt{\frac{1}{\cos^2 x}}$$

$$\sin x \left(\frac{1}{\sqrt{\cos^2 x}}\right)$$

$$\sin x \left(\frac{1}{\cos x}\right)$$

$$\frac{\sin x}{\cos x} = \tan x \quad \text{Q.E.D}$$

(S4) Simple Trigonometric Equations (Pure Yv1)

1) a) $x = \sin^{-1}(0.5)$

$x = 30 \pm 360n$
 $x = 150 \pm 360n$

$x = 30, 150$ ✓

b) $x = \cos^{-1}(0.5)$

$x = 60 \pm 360n$
 $x = 300 \pm 360n$

$x = 60, 300$ ✓

c) $x = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

$x = 30^\circ \pm 360n$
 $x = 330 \pm 360n$

$x = 30, 330$ ✓

d) $x = \cos^{-1}(0)$

$x = 90 \pm 360n$
 $x = 270 \pm 360n$

$x = 90, 270$ ✓

e) $x = \sin^{-1}\left(\frac{\sqrt{2}}{2}\right)$

$x = 45 \pm 360n$
 $x = 135 \pm 360n$

$x = 45, 135$ ✓

f) $x = \tan^{-1}(1)$

$x = 45 \pm 180n$
 $x = 45, 225$ ✓

2) a) $x = \sin^{-1}(0.2)$

$x = 11.5 \pm 360n$
 $x = 168.5 \pm 360n$

$x = 11.5, 168.5$ ✓

b) $x = \cos^{-1}\left(-\frac{\sqrt{2}}{2}\right)$

$x = 135 \pm 360n$
 $x = 225 \pm 360n$

$x = 135, 225$ ✓

c) $x = \cos^{-1}(0.65)$

$x = 49.5 \pm 360n$
 $x = 310.5 \pm 360n$

$x = 49.5, 310.5$ ✓

d) $x = \sin^{-1}(-0.5)$

$x = -30 \pm 360n$
 $x = -150 \pm 360n$

$x = 330, 210$ ✓

e) $x = \tan^{-1}(-\sqrt{3})$

$x = -60 \pm 180n$
 $x = 120, 300$ ✓

f) $x = \tan^{-1}(-2)$

$x = -63.4 \pm 180n$
 $x = 116.6, 296.6$ ✓

3) $2\sin x - 1 = 0$

$2\sin x = 1$
 $\sin x = \frac{1}{2}$
 $x = \sin^{-1}\left(\frac{1}{2}\right)$

$x = 30 \pm 360n$
 $x = 150 \pm 360n$

$x = 30, 390$
 $x = 150, 510$

1) a) $4\sin x = 2$

$\sin x = \frac{1}{2}$
 $x = \sin^{-1}\left(\frac{1}{2}\right)$
 $x = 30 \pm 360n$
 $x = 150 \pm 360n$

$x = 30, 150$

b) $\cos x + 1 = 0.5$

$\cos x = -0.5$
 $x = \cos^{-1}(-0.5)$

$x = 120 \pm 360n$
 $x = 240 \pm 360n$

$x = 120, -120$

c) $5\cos x = 1$

$\cos x = \frac{1}{5}$
 $x = \cos^{-1}\left(\frac{1}{5}\right)$

$x = 78.5 \pm 360n$
 $x = 281.5 \pm 360n$

$x = 78.5, -78.5$

d) $3 + \cos x = 0$

$\cos x = -3$
 No solutions.

e) $2\sin x = -\sqrt{3}$

$\sin x = -\frac{\sqrt{3}}{2}$
 $x = \sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

$x = -60 \pm 360n$
 $x = -120 \pm 360n$

$x = -60, -120$

f) $\tan x + 2 = 1$

$\tan x = -1$
 $x = \tan^{-1}(-1)$

$x = -45 \pm 180n$
 $x = -45, 135$

g) $3\tan x = -\sqrt{3}$

$\tan x = -\frac{\sqrt{3}}{3}$
 $x = \tan^{-1}\left(-\frac{\sqrt{3}}{3}\right)$

$x = -30 \pm 180n$

$x = -30, 150$

2) a) $\tan x = \frac{\sin x}{\cos x}$

b) $5\sin x = 4\cos x$

$\frac{\sin x}{\cos x} = \frac{4}{5}$

$\tan x = \frac{4}{5}$

$x = \tan^{-1}\left(\frac{4}{5}\right)$

$x = 38.7 \pm 180n$
 $x = 38.7, 218.7$

3) a) $2, \pm\sqrt{3}$

b) $\tan^2 x = 3$

$\tan x = \pm\sqrt{3}$

$\tan x = \sqrt{3}$ | $\tan x = -\sqrt{3}$

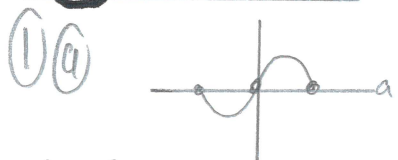
$x = \tan^{-1}(\sqrt{3})$ | $x = \tan^{-1}(-\sqrt{3})$

$x = 60 \pm 180n$ | $x = -60 \pm 180n$

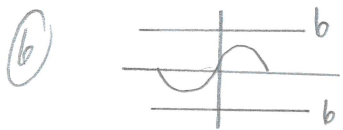
$x = 60, 240$ | $x = 120, 300$

$\therefore x = 60, 120, 240, 300$

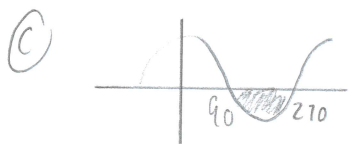
(S4) Continued



$$a=0$$



$$b > 1 \text{ or } b < -1$$



$$0 \leq c < 1$$

$$(2) \frac{\cos x}{\sin x} = \frac{1}{\tan x}$$

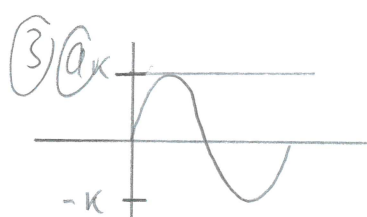
$$\therefore \frac{1}{\tan x} = \frac{1}{10}$$

$$\tan x = 10$$

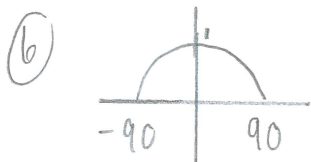
$$x = \tan^{-1}(10)$$

$$x = 84.3 \pm 180n$$

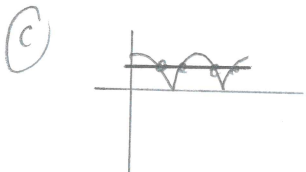
$$x = -95.7, 84.3$$



0 solutions as $x > 90$



$p > 1$ or $p < 0$



4

(d) 2

(55) Haver

Trigonometric Equations

① $2x = \sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

$2x = 60 \pm 360n$

$2x = 120 \pm 360n$

$x = 30 \pm 180n$

$x = 60 \pm 180n$

$x = 30, 210$

$x = 60, 240$

② (a) $x+30 = \cos^{-1}(0.5)$

$x+30 = 60 \pm 360n$

$x+30 = 300 \pm 360n$

$x = 30 \pm 360n$

$x = 270 \pm 360n$

$x = 30, 270$

(b) $3x = \tan^{-1}(1)$

$3x = 45 \pm 180n$

$x = 15 \pm 60n$

$x = 15, 75, 135, 195, 255, 315$

(c) $2x-60 = \sin^{-1}(0.1)$

$2x-60 = 5.7 \pm 360n$

$2x-60 = 174.3 \pm 360n$

$2x = 65.7 \pm 360n$

$x = 234.3 \pm 360n$

$x = 65.7, 234.3$

(d) $x+45 = \tan^{-1}(0.85)$

$x+45 = 40.4 \pm 180n$

$x = -4.6 \pm 180n$

$x = 175.4, 355.4$

(e) $4x = \cos^{-1}(0.4)$

$4x = 66.4 \pm 360n$

$4x = 293.6 \pm 360n$

$x = 16.6 \pm 90n$

$x = 73.4 \pm 90n$

$x = 16.6, 106.6, 196.6, 286.6, 73.4, 163.4, 253.4, 343.4$

(f) $0.5x = \sin^{-1}(1)$

$0.5x = 90 \pm 360n$

$0.5x = 90 \pm 360n$

$x = 180 \pm 720$

$x = 180$

(g) $\cos(x-10) = 0.1$

$(x-10) = \cos^{-1}(0.1)$

$x-10 = 84.3 \pm 360n$

$x-10 = 275.7 \pm 360n$

$x = 94.3 \pm 360n$

$x = 285.7 \pm 360n$

$x = 94.3, 285.7$

(3) $2x-60 = \cos^{-1}(0.5)$

$2x-60 = 60 \pm 360n$

$2x-60 = 300 \pm 360n$

$2x = 120 \pm 360n$

$2x = 360 \pm 360n$

$x = 60 \pm 180n$

$x = 180 \pm 180n$

$x = 60, 240, \checkmark$

$x = 180, 360, \checkmark$

N.B You can do your own method here!

① (a) $2x+30 = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

$2x+30 = 30 \pm 360n$

$2x+30 = 330 \pm 360n$

$2x = 0 \pm 360n$

$2x = 300 \pm 360n$

$x = 0 \pm 180n$

$x = 150 \pm 180n$

$x = 0, 180, 360$

$x = 150, 330$

(b) $\tan(x-25) = \frac{1}{\sqrt{3}}$

$x-25 = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$

$x-25 = 30 \pm 180n$

$x = 55 \pm 180n$

$x = 55, 235$

(c) $3x-30 = \sin^{-1}(-0.5)$

$3x-30 = -30 \pm 360n$

$3x-30 = -150 \pm 360n$

$3x = 0 \pm 360n$

$3x = -120 \pm 360n$

$x = 0 \pm 120n$

$x = -40 \pm 120n$

$x = 0, 120, 240, 360$

$x = 80, 200, 320$

SS Continued.

① a) $3x = \cos^{-1}(-1)$

$3x = 180 \pm 360n$

$3x = 180 \pm 360n$

$x = 60 \pm 120n$

$x = 60, 180, 300$

e) $x - 16 = \cos^{-1}(-0.25)$

$x - 16 = 104.5 \pm 360n$

$x - 16 = 255.5 \pm 360n$

$x = 120.5 \pm 360n$

$x = 271.5 \pm 360n$

$x = 120.5, 271.5$

f) $4x - 60 = \sin^{-1}(-0.85)$

$4x - 60 = -58.2 \pm 360n$

$4x - 60 = -121.8 \pm 360n$

$4x = 1.8 \pm 360n$

$4x = -61.8 \pm 360n$

$x = 0.4 \pm 90n$

$x = -15.4 \pm 90n$

$x = 0.4, 90.4, 180.4, 270.4$
 $x = 74.6, 164.6, 254.6, 344.6$

g) $\cos(0.5x) = 0.8$

$0.5x = \cos^{-1}(0.8)$

$0.5x = 36.9 \pm 360n$

$0.5x = 323.1 \pm 360n$

$x = 73.7 \pm 720n$

$x = 646.3 \pm 720n$

$x = 73.7$

⑦ a) $\tan(3x) = \frac{\sin(3x)}{\cos(3x)}$

b) $\frac{\sin(3x)}{\cos(3x)} = 1$

$\tan(3x) = 1$

$3x = \tan^{-1}(1)$

$3x = 45 \pm 180n$

$x = 15 \pm 60n$

$x = -165, -105, -45$
 $15, 75, 135$

③ $\sin^2 x = \frac{1}{4}$

$\sin x = \pm \sqrt{\frac{1}{4}}$

$\sin x = \pm \frac{1}{2}$

$\sin x = \frac{1}{2}$

$x = \sin^{-1}(\frac{1}{2})$

$x = 30 \pm 360n$

$x = 150 \pm 360n$

$x = 30, 150$

$\sin x = -\frac{1}{2}$

$x = \sin^{-1}(-\frac{1}{2})$

$x = -30 \pm 360n$

$x = -150 \pm 360n$

$x = 210, 330$

① a) $\frac{\sin x}{\cos x} = \tan x$

$\frac{\sin(x+30)}{\cos(x+30)} = \frac{1}{\sqrt{3}}$

$\tan(x+30) = \frac{1}{\sqrt{3}}$

$x+30 = \tan^{-1}(\frac{1}{\sqrt{3}})$

$x+30 = 30 \pm 180n$

$x = 0 \pm 180n$

$x = 0, -180$

b) $\sin^2(3\theta - 45) = \frac{1}{4}$

$\sin(3\theta - 45) = \pm \frac{1}{2}$

$\sin(3\theta - 45) = \frac{1}{2}$

$3\theta - 45 = 30 \pm 360n$

$3\theta - 45 = 150 \pm 360n$

$\theta = 25 \pm 120n$

$\theta = 65 \pm 120n$

$\sin(3\theta - 45) = -\frac{1}{2}$

$3\theta - 45 = -30 \pm 360n$

$3\theta - 45 = -150 \pm 360n$

$\theta = 5 \pm 120n$

$\theta = -35 \pm 120n$

$\theta = 25, 145, -105$

$\theta = 65, -55, -175$

$\theta = 5, 125, -115$

$\theta = -35, 85, -155$

② $\begin{cases} ax - b = 60 \pm 360n \\ 9x - b = 120 \pm 360n \end{cases}$

$\therefore 22.5a - b = 60$ ①

$37.5a - b = 120$ ②

$15a = 60$

$a = 4$

① $22.5(4) - b = 60$

$b = 30$

③ $(\tan 3x)(2\cos x + 5) = 0$

$\tan 3x = 0$

$3x = \tan^{-1}(0)$

$3x = 0 \pm 180n$

$x = 0 \pm 60n$

$x = 0, 60, 120, 180$

$-60, -120, -180$

$2\cos x + 5 = 0$
 $\cos x = -\frac{5}{2}$
 no solutions