KS5 "Full Coverage": Trigonometric Equations (Yr1)

This worksheet is designed to cover one question of each type seen in past papers, for each A Level topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com, logging on, *Practise* → *Past Papers* (or *Library* → *Past Papers* for teachers), and using the 'Revision' tab.

Question 1

Categorisation: Solve equations of the form $\boldsymbol{sin(x+a)=b}$ or $\boldsymbol{a\,sin\,(x+b)=c}$ for a given range.

[Edexcel C2 May 2011 Q7a]

Solve for $0 \leq x < 360^\circ$, giving your answers in degrees to 1 decimal place,

$$3\,sin\left(x+45^\circ\right)=2$$

$x =$ ..... $^\circ$

$x =$ ..... $^\circ$

Question 2

Categorisation: Solve equations of the form $\boldsymbol{sin(ax+b)=c}$

[Edexcel AS Specimen Papers P1 Q11i]

Solve, for $-90^\circ \leq \theta < 270^\circ$, the equation,

$$sin\left(2\theta+10^\circ\right)=-0.6$$

giving your answers to one decimal place.

$\theta =$ ..... $^\circ$

$\theta =$ ..... $^\circ$

$\theta =$ ..... $^\circ$

$\theta =$ ..... $^\circ$

Question 3

Categorisation: As above.

[Edexcel C2 Jan 2012 Q9i]

Find the solutions of the equation $sin\left(3x - 15^\circ\right) = \frac{1}{2}$, for which $0 \leq x \leq 180^\circ$

$x = \ldots\ldots\ldots\ldots\ldots\ldots\ldots^\circ$

$x = \ldots\ldots\ldots\ldots\ldots\ldots\ldots^\circ$

$x = \ldots\ldots\ldots\ldots\ldots\ldots\ldots^\circ$

$x = \ldots\ldots\ldots\ldots\ldots\ldots\ldots^\circ$

Question 4

Categorisation: Solve an equation involving tan.

[Edexcel C2 May 2013 Q8i]

Solve, for $-180^\circ \leq x < 180^\circ$,

$$tan\left(x - 40^\circ\right) = 1.5$$

giving your answers to 1 decimal place.

$x = \ldots\ldots\ldots\ldots\ldots\ldots\ldots^\circ$

$x = \ldots\ldots\ldots\ldots\ldots\ldots\ldots^\circ$

Question 5

Categorisation: Solve a trigonometric equation requiring prior manipulation.

[Edexcel C2 May 2014(R) Q7i]

Solve, for $0 \leq \theta < 180^\circ$, the equation

$$\frac{sin\ 2\theta}{(4\ sin\ 2\theta - 1)} = 1$$

giving your answers to 1 decimal place.

$\theta =$ ..... $^\circ$

$\theta =$ ..... $^\circ$

Question 6

Categorisation: Solve an equation involving tan with either sin or cos.

[Edexcel C2 May 2014 Q7ii]

Solve, for $-180^\circ \leq x < 180^\circ$, the equation

$$2\ tan\ x - 3\ sin\ x = 0$$

giving your answers to 2 decimal places where appropriate.
[Solutions based entirely on graphical or numerical methods are not acceptable.]

$x =$ ..... $^\circ$

$x =$ ..... $^\circ$

$x =$ ..... $^\circ$

$x =$ ..... $^\circ$

Question 7

Categorisation: As above, but where the argument of the trig functions is of the form $ax + b$.

[Edexcel AS Specimen Papers P1 Q11iib]

Find the smallest positive solution to the equation

$$7\ tan\left(4\alpha + 199^\circ\right) = 8\ sin\left(4\alpha + 199^\circ\right)$$

$\alpha =$ ..... $^\circ$

Question 8

Categorisation: Use the identity $sin^2 x + cos^2 x = 1$ to solve a trig equation.

[Edexcel A2 SAM P2 Q12a]

Solve, for $-180^\circ \leq x < 180^\circ$, the equation

$$3\ sin^2 x + \ sin\ x + 8 = 9\ cos^2 x$$

giving your answers to 2 decimal places.

..... $^\circ$

..... $^\circ$

..... $^\circ$

..... $^\circ$

Question 9

Categorisation: As above, but for a less standard range.

[Edexcel AS SAM P1 Q9]

Solve, for $360^\circ \leq x < 540^\circ$,

$$12\ sin^2 x + 7\ cos\ x - 13 = 0$$

Give your answers to one decimal place.

(Solutions based entirely on graphical or numerical methods are not acceptable.)

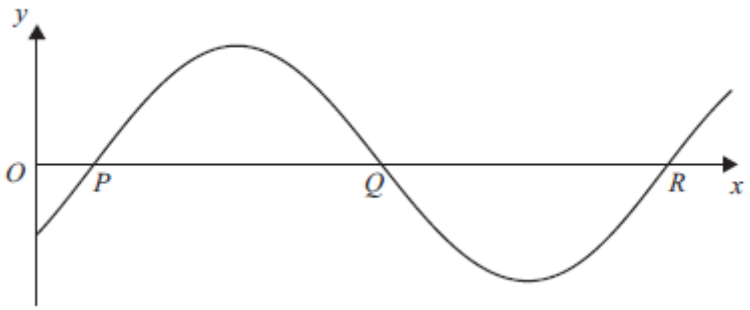
$x =$ ..... $^\circ$

$x =$ ..... $^\circ$

Question 10

Categorisation: Use the roots of a graph to determine a trigonometric function.

[Edexcel C2 Jan 2012 Q9ii Edited]



The figure shows part of the curve with equation

$y = sin\ (ax - b)$, where $a > 0$, $0 < b < 180^\circ$

The curve cuts the x -axis at the points P , Q and R as shown. Given that the coordinates of P, Q and R are $(18^\circ, 0)$, $(108^\circ, 0)$ and $(198^\circ, 0)$ respectively, find the values of a and b .

$a =$ .....

$b =$ ..... $^\circ$

Question 11

Categorisation: Solve an equation involving sin and cos.

[Edexcel C2 June 2010 Q5b]

Solve, for $0 \leq x < 360^\circ$,

$$5 \sin 2x = 2 \cos 2x$$

giving your answers to 1 decimal place.

$x =$ ..... $^\circ$

$x =$ ..... $^\circ$

$x =$ ..... $^\circ$

$x =$ ..... $^\circ$

Question 12

Categorisation: Complete the square for a trigonometric equation.

[Edexcel C2 May 2017 Q8a Edited]

Show that the equation

$$\cos^2 x = 8 \sin^2 x - 6 \sin x$$

can be written in the form $(a \sin x - 1)^2 = b$ where a and b are constants to be found.

.....

Question 13

Categorisation: Solve a more complex trigonometric equation involving a mixture of sin, cos and tan.

[OCR C2 June 2017 Q9iia Edited]

Show that the equation

$$4\ sin\ 2\theta\ cos\ 2\theta + \frac{5}{cos\ 2\theta} = 13\ tan\ 2\theta$$

can be expressed in the form

$$4\ sin^{3} 2\theta + a\ sin\ 2\theta + b = 0$$

where a and b are constants to be found.

.....

Question 14

Categorisation: Put a trigonometric equation in a required form.

[OCR C2 Jan 2013 Q5i Edited]

Show that the equation $2\ sin\ x = \frac{4\ cos\ x - 1}{tan\ x}$ can be expressed in the form

$$6\ cos^{2} x - \ cos\ x + a = 0$$

where a is a constant to be found.

.....

Answers

Question 1

$x =$ 93.2 $^\circ$ and $x =$ 356.8 $^\circ$

Question 2

$\theta =$ -76.6 $^\circ$ and $\theta =$ -23.4 $^\circ$ and $\theta =$ 103.4 $^\circ$ and $\theta =$ 156.6 $^\circ$

Question 3

$x =$ 55 $^\circ$ and $x =$ 135 $^\circ$ and $x =$ 175 $^\circ$ and $x =$ 15 $^\circ$

Question 4

$x =$ -83.7 $^\circ$ and $x =$ 96.3 $^\circ$

Question 5

$\theta =$ 9.7 $^\circ$ and $\theta =$ 80.3 $^\circ$

Question 6

$x =$ -180 $^\circ$ and $x =$ -48.2 $^\circ$ and $x =$0 $^\circ$ and $x =$ 48.2 $^\circ$

Question 7

$\alpha =$ 33.0 $^\circ$

Question 8

14.48 $^\circ$ and 165.52 $^\circ$ and -19.47 $^\circ$ and -160.53 $^\circ$

Question 9

$x =$ 430.5 $^\circ$ and $x =$ 435.5 $^\circ$

Question 10

$a =$ 2 and $b =$ 36 $^\circ$

Question 11

$x =$ 10.9 $^\circ$ and $x =$ 100.9 $^\circ$ and $x =$ 190.9 $^\circ$ and $x =$ 280.9 $^\circ$

Question 12

$a = 3$, $b = 2$

Question 13

$a = 9$, $b = -5$

Question 14

$a = -2$