

NAME: _____

DATE: 04/17/15

ASSIGNMENT: Trigonometric Paper Preview

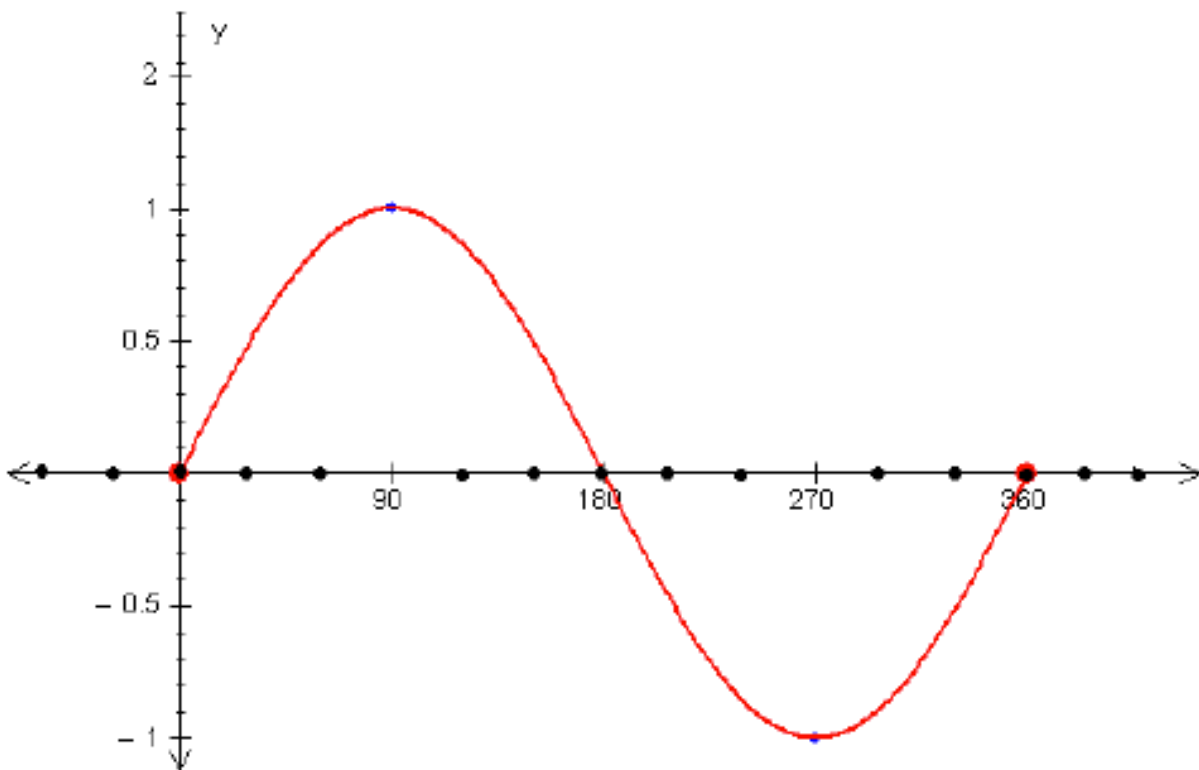
1.) Solve $\tan^2 2\theta = 1$, in the interval $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$.

Solution(s) = _____

2.) 1. [Maximum mark: 4]

The graph of $f(x) = \sin x$, $0 \leq x \leq \frac{\pi}{2}$

Sketch the graph of $h(x) = -f(x - \frac{\pi}{6}) + \frac{1}{2}$



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3.)

Consider the function $f(x) = \cos x + \sin x$.

(a) (i) Show that $f(-\frac{\pi}{4}) = 0$.

(ii) Find in terms of π , the smallest **positive** value of x which satisfies $f(x) = 0$.

[3 marks]

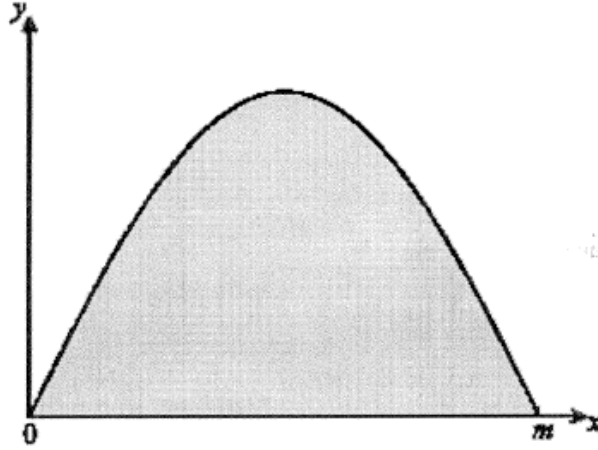
Solution: _____

4.) A tide can be modelled by the function $h(t) = 6 \cos \frac{2\pi}{12.2}(t - 4) + 8$, where h is the height of the water, in metres, and t is the number of hours past midnight.

(a) At what time of day does the tide first reach a maximum? {Ans: 04:00 }

(b) Determine the time of day at which the tide first attains a height of 3m.
Answer to the nearest minute. {Ans: 08:58}

- 5.) The diagram below shows part of the graph of $y = \sin 2x$. The shaded region is between $x = 0$ and $x = m$.



- (a) Write down the period of this function. [2 marks]
- (b) Hence or otherwise write down the value of m . [2 marks]

6.) Let $f(x) = \frac{1}{2} \cos^3 2x$

- a. Write down the period and range of the function $f(x)$ [3 marks]
- b. Consider $f(x) = -\frac{1}{16}$, $0 \leq x \leq \pi$. Write down the value(s) of x that satisfies the equation. [4 marks]
- c. Find the values of x for which the function $f(x)$ is maximum and minimum. [4 marks]

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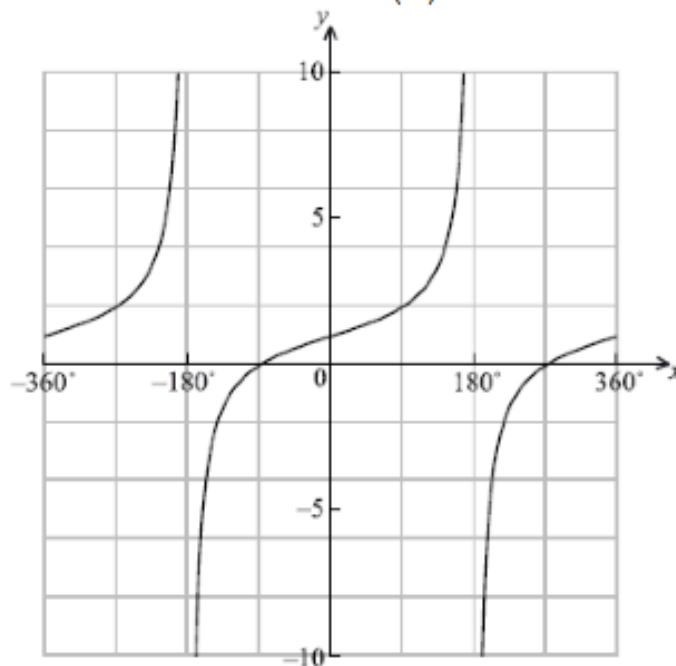
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7.) Given that $\cos 2x = -\frac{7}{25}$ for $0^\circ < x < 360^\circ$ and x is **obtuse** angle,

a. Show that $\sin x = \frac{4}{5}$

[3 marks]

8.) The diagram below shows the graph of $f(x) = 1 + \tan\left(\frac{x}{2}\right)$ for $-360^\circ \leq x \leq 360^\circ$.



(a) On the same diagram, draw the asymptotes.

[2 marks]

(b) Write down

(i) the period of the function;

(ii) the value of $f(90^\circ)$.

[2 marks]

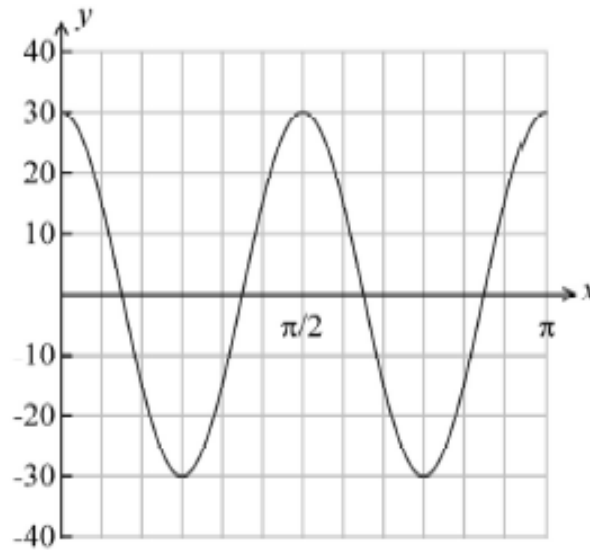
(c) Solve $f(x) = 0$ for $-360^\circ \leq x \leq 360^\circ$.

[2 marks]

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9.) The graph of a function of the form $y = p \cos qx$ is given in the diagram below.



- (a) Write down the value of p .
- (b) Calculate the value of q .

10.)

[Maximum mark: 7]

Solve $\cos 2x - 3 \cos x - 3 - \cos^2 x = \sin^2 x$, for $0 \leq x \leq 2\pi$.

Formulas

3.1	Length of an arc Area of a sector	$l = \theta r$ $A = \frac{1}{2}\theta r^2$
3.2	Trigonometric identity	$\tan \theta = \frac{\sin \theta}{\cos \theta}$
3.3	Pythagorean identity Double angle formulae	$\cos^2 \theta + \sin^2 \theta = 1$ $\sin 2\theta = 2 \sin \theta \cos \theta$ $\cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2 \cos^2 \theta - 1 = 1 - 2 \sin^2 \theta$
3.6	Cosine rule Sine rule Area of a triangle	$c^2 = a^2 + b^2 - 2ab \cos C$; $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$ $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $A = \frac{1}{2}ab \sin C$

11.)

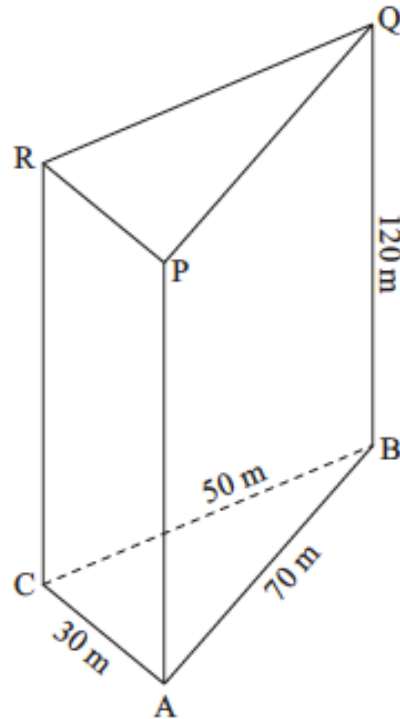
[Maximum mark: 10]

A spring is suspended from the ceiling. It is pulled down and released, and then oscillates up and down. Its length, l centimetres, is modelled by the function $l = 33 + 5 \cos((720t)^\circ)$, where t is time in seconds after release.

- (a) Find the length of the spring after 1 second. *[2 marks]*
- (b) Find the minimum length of the spring. *[3 marks]*
- (c) Find the first time at which the length is 33 cm. *[3 marks]*
- (d) What is the period of the motion? *[2 marks]*

12.)

An office block, ABCPQR, is built in the shape of a triangular prism with its “footprint”, ABC, on horizontal ground. $AB = 70$ m, $BC = 50$ m and $AC = 30$ m. The vertical height of the office block is 120 m.

*diagram not to scale*

- (a) Calculate the size of angle ACB. [3 marks]
- (b) Calculate the area of the building's footprint, ABC. [3 marks]
- (c) Calculate the volume of the office block. [2 marks]

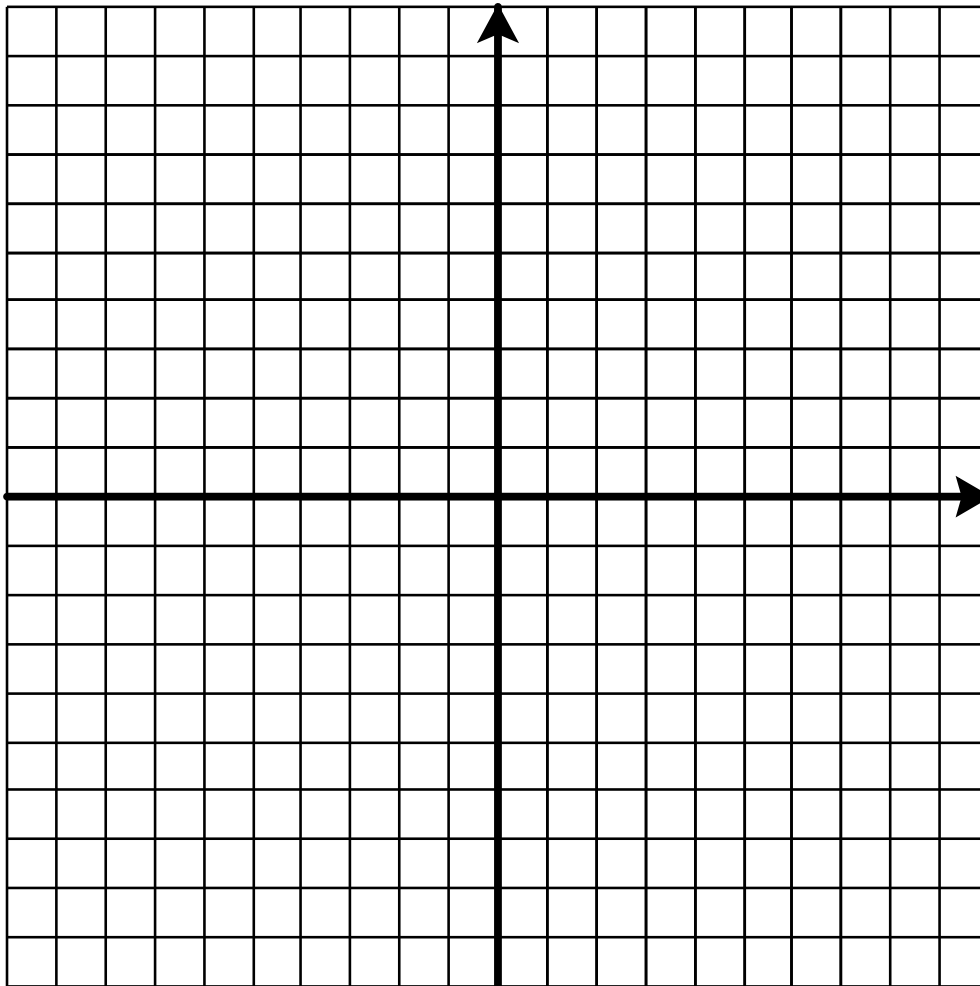
To stabilize the structure, a steel beam must be made that runs from point C to point Q.

- (d) Calculate the length of CQ. [2 marks]
- (e) Calculate the angle CQ makes with BC. [2 marks]

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13.) Graph $f(x) = 3\cos(x + \frac{\pi}{4}) + 1$ AND $g(x) = \cos x$ along the domain $-\pi \leq x \leq \pi$.



a.) What is the amplitude of $f(x)$? _____

b.) What is the period $f(x)$? _____

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Answer key (show all calculations for full marks):

- 1.) $\pi/8, -\pi/8$
- 2.) graph in radian mode to check
- 3.) $3\pi/4$
- 4.) answers are already on the problem
- 5.) π & $\pi/2$
- 6.) $\pi, -1/2 \leq y \leq 1/2, \pi/3$ & $2\pi/3$, max = 0 and π , min = $\pi/2$
- 7.) substitute $\cos^2 x$ with $2\cos^2 x - 1$ and show the steps until you find $\sin x = 4/5$
- 8.) $360^\circ, 2, 270^\circ$ & -90°
- 9.) 30, 4
- 10.) $x = \pi$
- 11.) 38 cm, 28 cm, 0.125 seconds, 0.5
- 12.) $\angle ACB = 120^\circ$; 650. m^2 ; 77,900 m^3 ; 130m; $\angle BCQ = 67.4^\circ$
- 13.) $a = 3, p = 2\pi$, set calc to radian mode to check graph in $Y =$