TRINITY COLLEGE

Year 11 Specialist
Test 4 – Part B 2019
Calculator Free
Trigonometry

STUDENT'S NAME ___SOLUTIONS___

DATE: Monday 5th August   **TIME:** 20 minutes   **MARKS:** 16

INSTRUCTIONS:
Standard Items: Pens, pencils, drawing templates, eraser and scientific calculator

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1.   (3 marks)

Find the exact value of all solutions to the equation: $\sin x = \dfrac{\sqrt{3}}{2}$

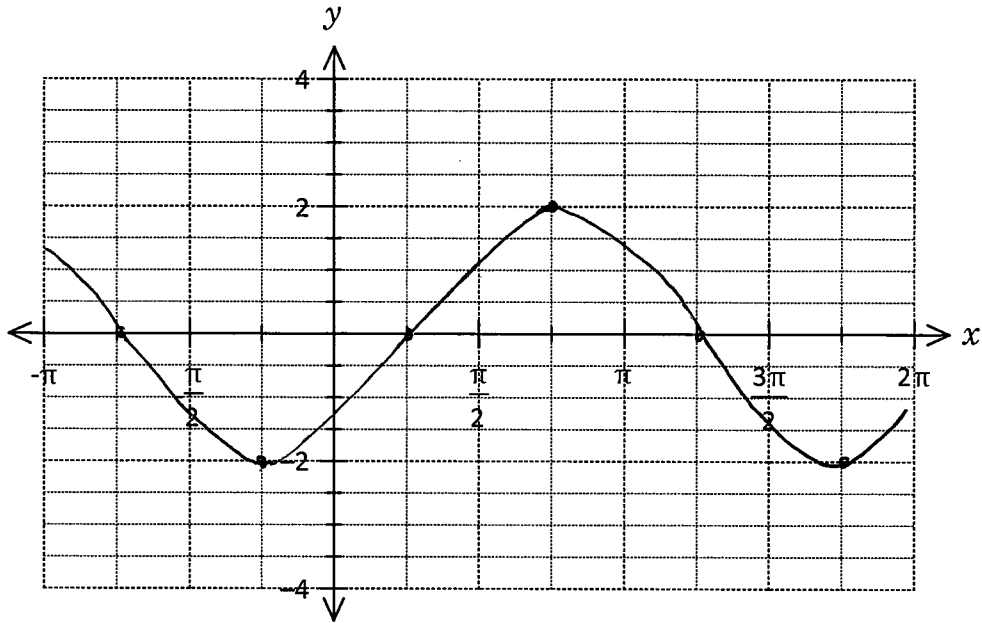$$x = \begin{cases} 60° + 360n \\ 120° + 360n \end{cases} , \quad n \in \mathbb{Z}$$

OR

$$x = \begin{cases} \dfrac{\pi}{3} + 2\pi n \\ \dfrac{2\pi}{3} + 2\pi n \end{cases} , \quad n \in \mathbb{Z}$$

2.   (4 marks)

Sketch the following trigonometric functions on the axes below, including any asymptotes.
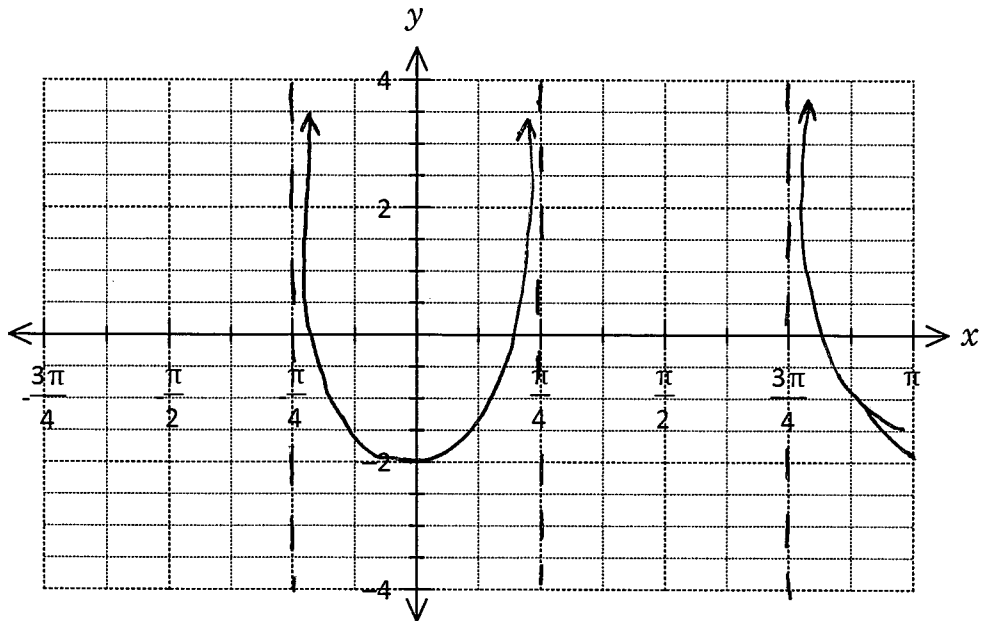
(a) $y = 2\sin(x - \frac{\pi}{4})$ [2]
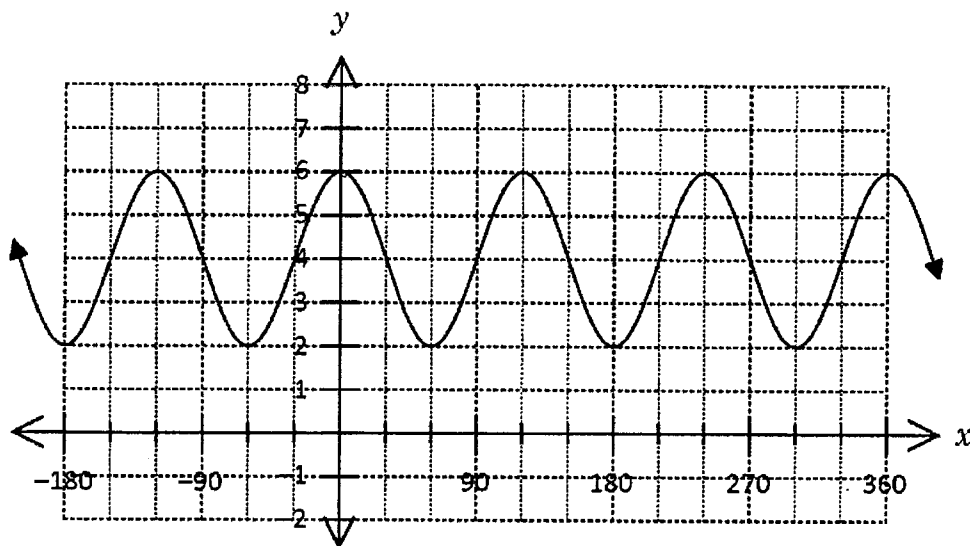

(b) $y = \sec(2x) - 3$ [2]

3.   (4 marks)

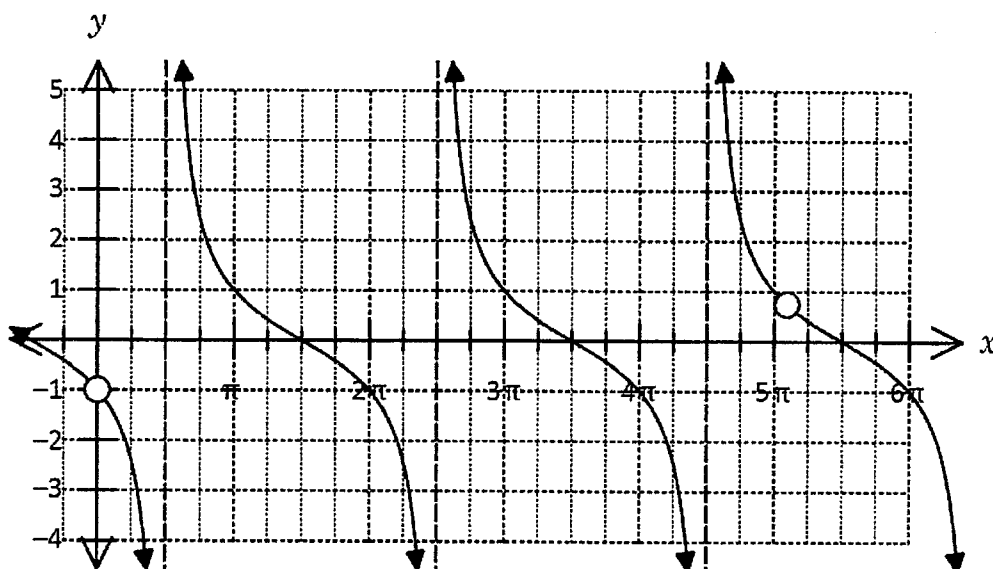Determine the equation for each of the following trigonometric functions.

(a)   [2]

$y = 2\cos 3x + 5$

(b)   [2]

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

$y = \cot \left(0.5x - \frac{\pi}{4}\right)$

4. (5 marks)

Solve: $\cos 5x \sin 3x - \sin 4x \cos 4x = 1/2 \sin x$ for $-\pi \le x \le \pi$

$$\frac{1}{2}\left[\sin 8x - \sin 2x\right] - \frac{1}{2}\sin 8x = \frac{1}{2}\sin x$$

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

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

$$0 = 2\sin x \cos x - \sin x$$

$$0 = \sin x (2\cos x - 1)$$

$\sin x = 0$ 　　　　　　　 $2\cos x - 1 = 0$

$x = 0, \pm\pi$ 　　　　　　 $\cos x = \frac{1}{2}$

　　　　　　　　　　　　　 $x = \pm\frac{2\pi}{3}$

$$\therefore x = 0, \pm\frac{2\pi}{3}, \pm\pi$$

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SOLUTIONS

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DATE: Monday 5th August   **TIME:** 10 minutes   **MARKS:** 8

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5.   (8 marks)

The height of the tide above mean sea level at a certain port can be modelled by the equation
$h(t) = 4\sin(\frac{\pi t}{6} - \frac{\pi}{2})$ where t is the number of hours after 9pm on a day.

(a)   When is the first high tide?   [2]

$t = 6$

$\therefore$ 3am

(b)   What is the range of tides at this port?   [1]

$-4 \to 4$

$\therefore$ 8m

(c)   What was the height of the tide at noon the following day? Was it going out or coming in at this time?   [2]

$t = 0$,   height $= 0$,   coming in

(d)   Safety regulations state that a ship can only enter the port when there is a clearance of 3m of water above the low tide. What is the earliest time that a ship could safely enter or leave the port?   [3]

$y = -1$

$t = 2.5174$ hrs

$\therefore$ 11:31pm