TRINITY ✠ COLLEGE

Mathematics Specialist
Test 4   2020

Section 1   Calculator Free
Trigonometry

STUDENT'S NAME _____

DATE: Wednesday 22nd July   **TIME:** 30 minutes   **MARKS**: 32

INSTRUCTIONS:
Standard Items: Pens, pencils, drawing templates, eraser

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.
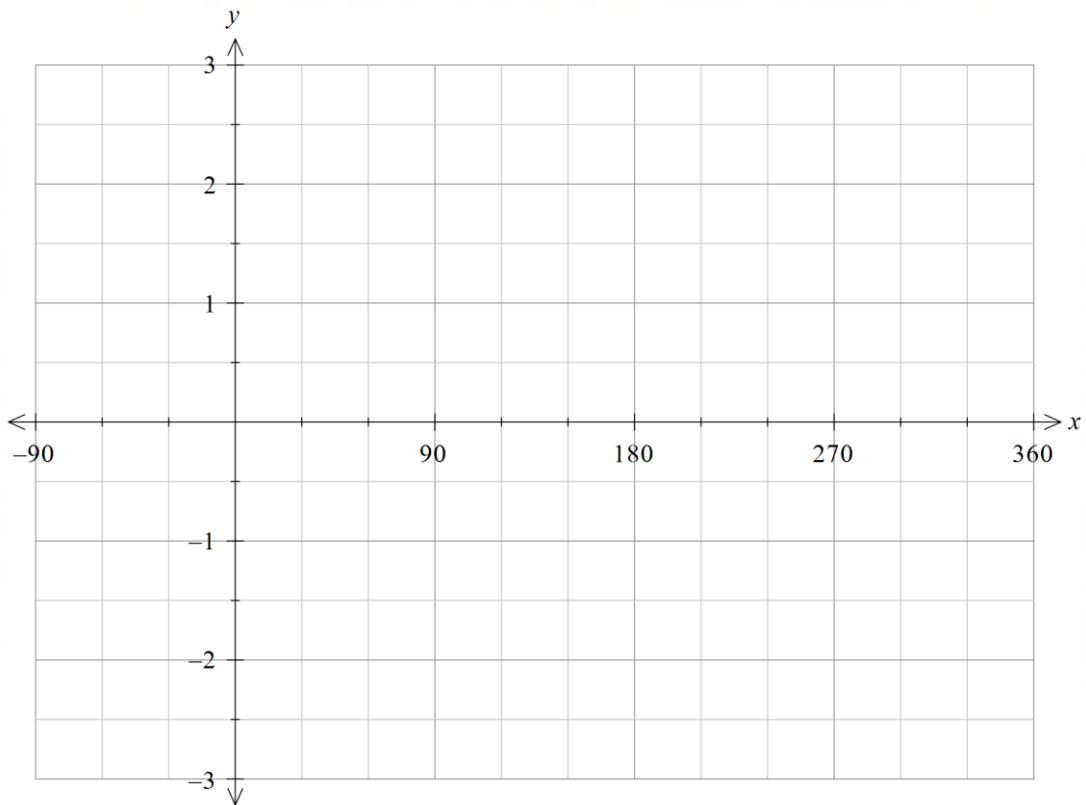_____

1.   (3 marks)

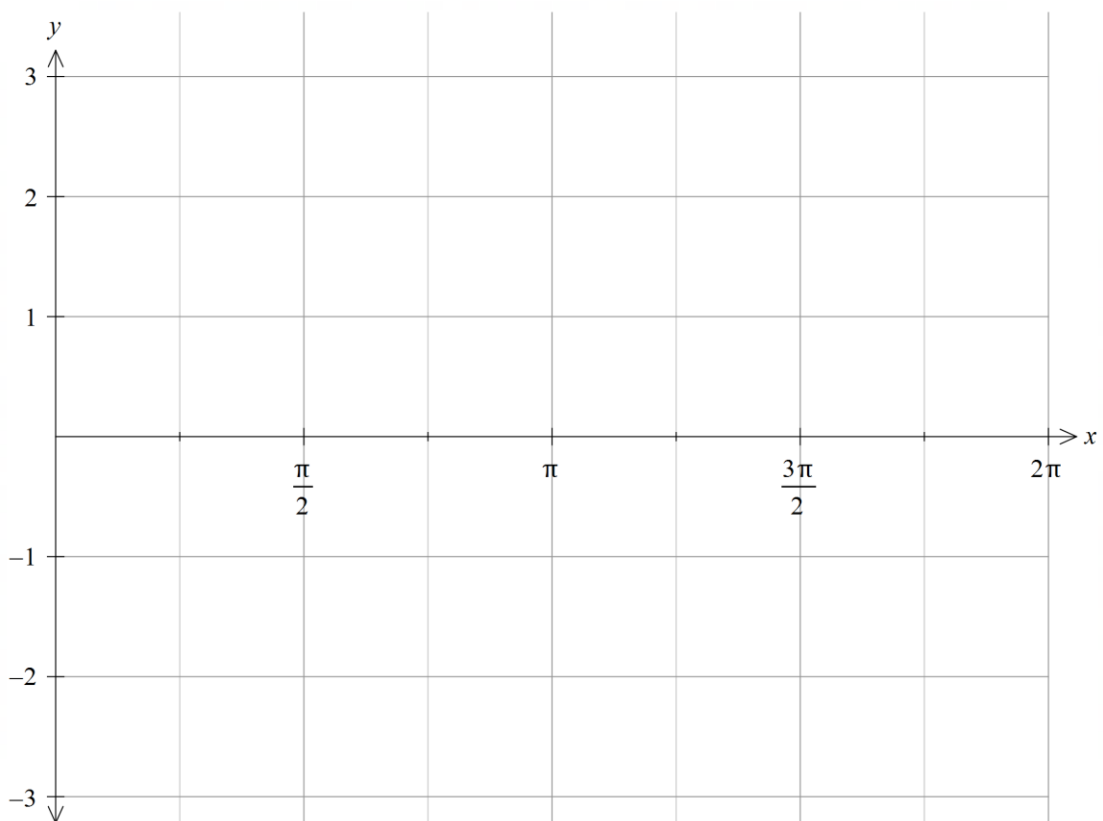Determine the exact value of $\cos 75°$.

2.   (8 marks)

(a)   Sketch the function $y = -2\sin(2(x + 30°))$ on the axes below.   [4]

(b)   Sketch the function $y = \operatorname{cosec}\left(2\left(x - \dfrac{\pi}{4}\right)\right)$ on the axes below.   [4]

3.   (8 marks)

Given that $\cos \theta = \dfrac{3}{5}$ where $0 \leq \theta \leq 90°$, and $\sin \beta = \dfrac{1}{3}$ where $90° \leq \beta \leq 180°$

Determine:

(a) $\cos(\theta + \beta)$ [4]

(b) $\tan(2\theta)$ [4]

4.   (8 marks)

Solve

(a) $\tan(2x + 15°) = -1$ for $0° \le x \le 180°$ [3]

(b) $\sqrt{3} \sin x + \cos x = \sqrt{2}$ for $0 \le x \le 2\pi$ by expressing in the form
$R \sin(x + \alpha) = c$ [5]

5. (5 marks)

Solve $2\sin^2\theta - \sqrt{3}\sin\theta = 0$ given θ in radians.

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Section 2   Calculator Assumed
Trigonometry

STUDENT'S NAME   _____

DATE: Wednesday 22nd July   **TIME:** 20 minutes   **MARKS**: 20

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser
Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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6.   (4 marks)

Determine the equation of the function shown below, *x* in radians
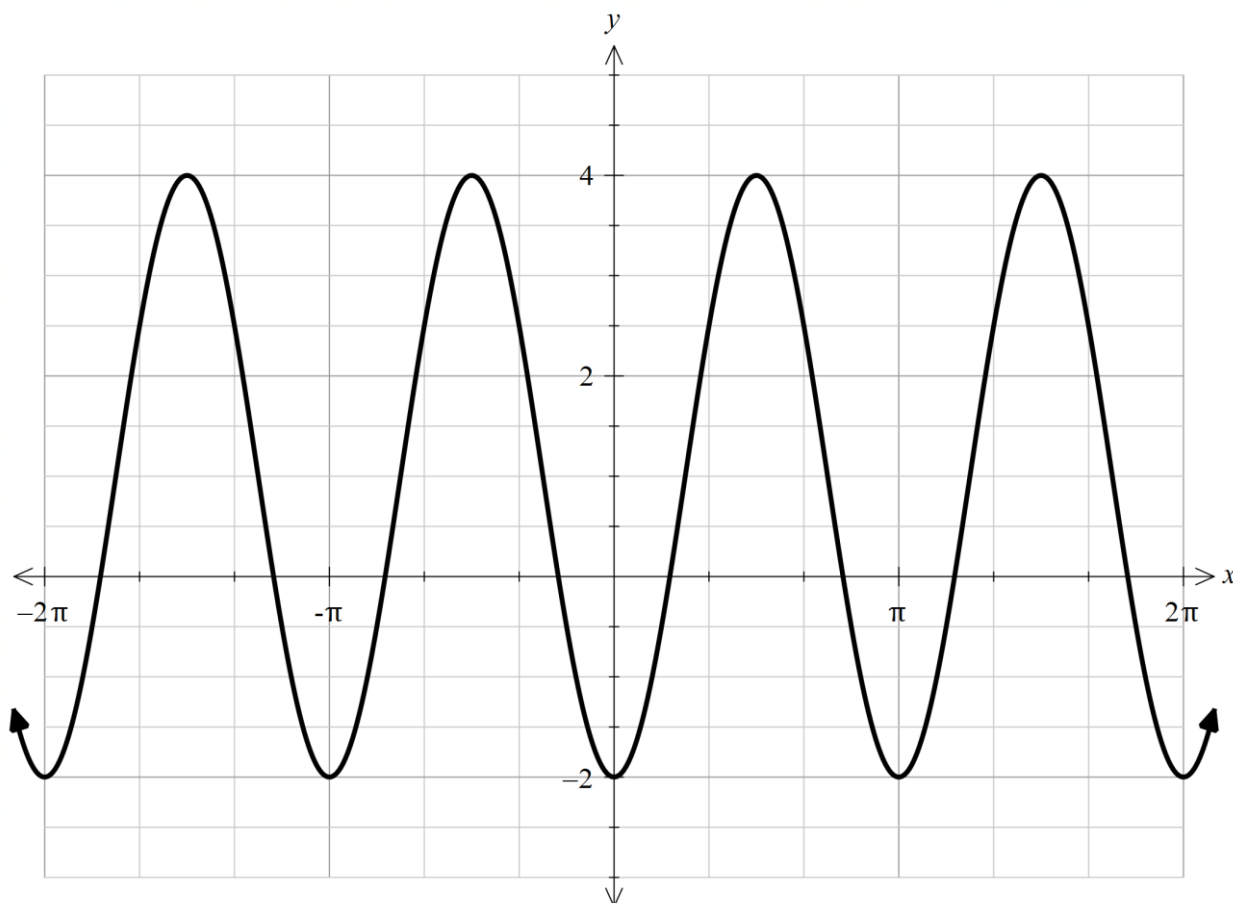
7. (9 marks)

A radio wave follows the path of the equation $h = 9 \sin\left(\dfrac{\pi t}{4}\right) + \cos\left(\dfrac{\pi t}{4}\right)$, where h

(metres) is the height from a mean level and t (hours) is the time after 9 a.m.

(a) Express $9 \sin\left(\dfrac{\pi t}{4}\right) + \cos\left(\dfrac{\pi t}{4}\right)$ in the form $r \sin\left(\dfrac{\pi t}{4} + \alpha\right)$ [3]

(b) Determine the height of the radio waves at 9 a.m. [1]

(c) Determine the height of the radio waves at 11 a.m. [2]

(d) Determine the time(s) in a 24-hour period when the height of the radio waves returns to that of 9 a.m. [3]

8.   (7 marks)

Prove each of the following.

(a) $\cos^2 A - \sin^2 B = \cos(A + B)\cos(A - B)$ [3]

(b) $\dfrac{1 + \cot\theta}{\cosec\theta} - \dfrac{\sec\theta}{\cot\theta + \tan\theta} = \cos\theta$ [4]