

**Year 11 Mathematics Specialist  
Test 4 2022**

**Section 1 Calculator Free  
Trigonometric Functions**

**STUDENT'S NAME** \_\_\_\_\_

**DATE:** Wednesday 3<sup>rd</sup> August

**TIME:** 30 minutes

**MARKS:** 37

**INSTRUCTIONS:**

Standard Items: Pens, pencils, drawing templates, eraser, approved Formula sheet

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

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1. (3 marks)

Evaluate  $\cos\left(\frac{5\pi}{12}\right)\sin\left(\frac{7\pi}{12}\right)$

2. (11 marks)

(a) Solve  $\cos\left(2x - \frac{\pi}{4}\right) = \frac{1}{2}$  [3]

(b) Solve  $\cos(2\theta) - \cos\theta = 0$  for  $0 \leq x \leq 2\pi$  [4]

(c) Solve  $3\operatorname{cosec} 2\theta = -2\sqrt{3}$  for  $-180^\circ \leq x \leq 180^\circ$  [4]

3. (6 marks)

Prove the following.

(a)  $\frac{1}{1 + \tan^2 \theta} = \cos^2 \theta$  [2]

(b)  $\cos (P + Q) \cos (P - Q) = \cos^2 P + \cos^2 Q - 1$  [4]

4. (8 marks)

Prove the following.

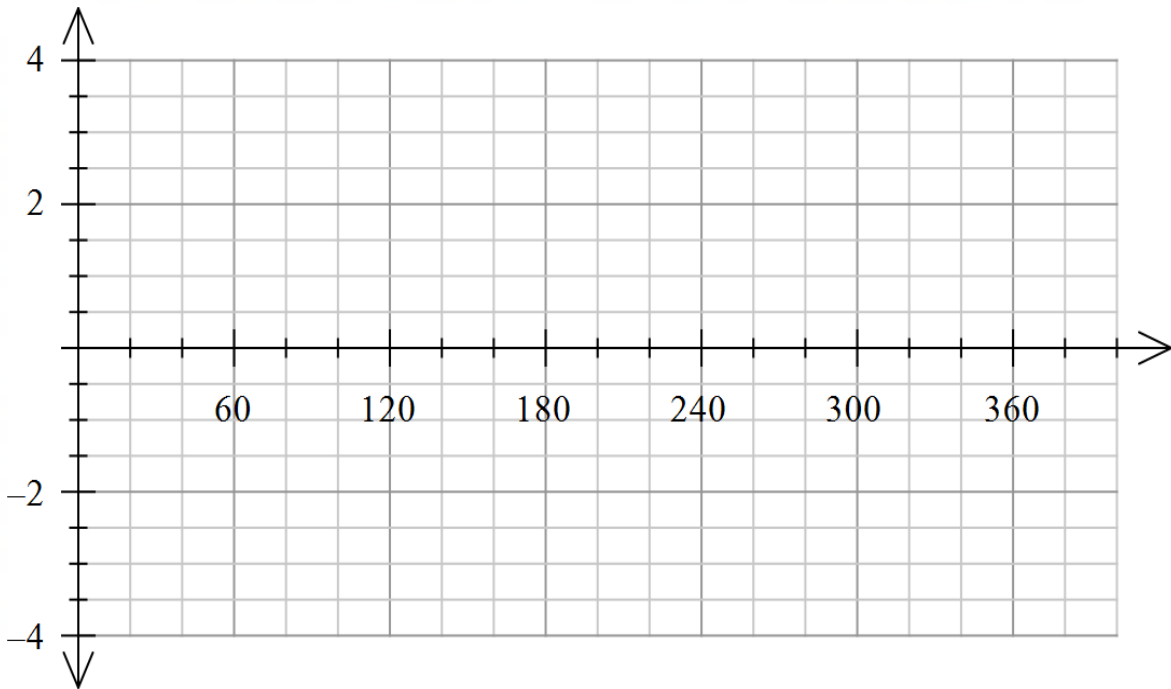
(a)  $\cot\left(\frac{x}{2}\right) + \tan\left(\frac{x}{2}\right) = 2\operatorname{cosec}(x)$  [4]

(b)  $1 + 2\operatorname{cosec}\theta \cot\theta + 2\cot^2\theta = \frac{1 + \cos\theta}{1 - \cos\theta}$  [4]

5. (6 marks)

(a) Sketch  $f(x) = 2\sec(x - 30^\circ)$  on the graph below.

[3]



(b) Simplify  $\frac{\sin 6B + \sin 2B}{\sin 6B - \sin 2B}$

[3]

Q \_\_\_\_\_

**Year 11 Mathematics Specialist  
Test 1 2022**

**Section 2 Calculator Assumed  
Trigonometric Functions**

**STUDENT'S NAME** \_\_\_\_\_

**DATE:** Wednesday 3<sup>rd</sup> August

**TIME:** 20 minutes

**MARKS:** 16

**INSTRUCTIONS:**

Standard Items: Pens, pencils, drawing templates, eraser, approved Formula sheet

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. (5 marks)

Let the angle  $\theta = \frac{\pi}{3} - \frac{\pi}{4} = \frac{\pi}{12}$ .

(a) Use your calculator to determine an exact value for  $\sin\left(\frac{\pi}{12}\right)$ . [1]

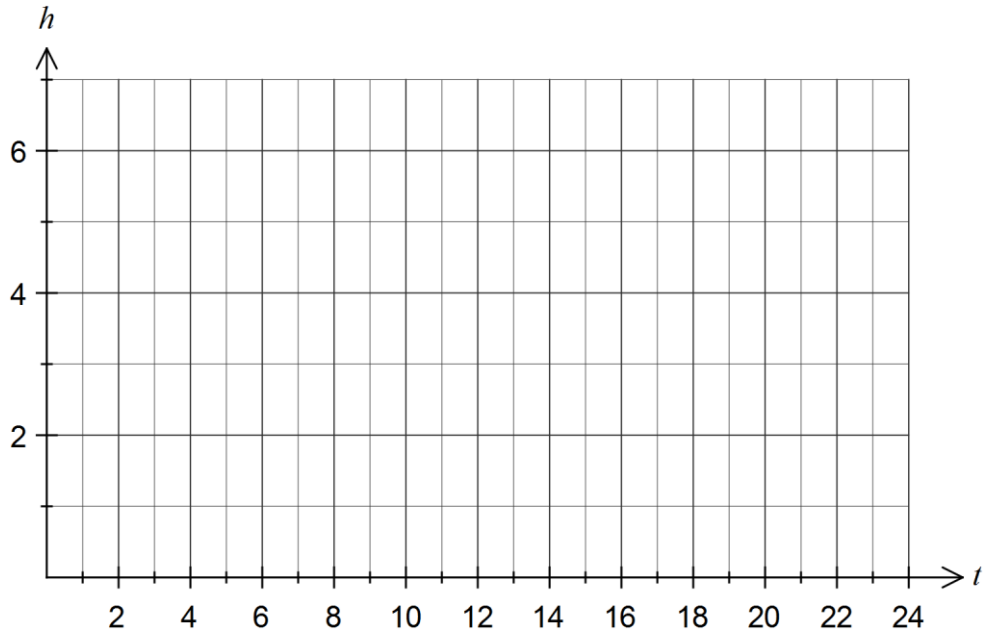
(b) Use an angle sum or difference identity to show how to obtain the above exact value for  $\sin\left(\frac{\pi}{12}\right)$ . [4]



7. (5 marks)

The clearance,  $h$  metres, under a bridge spanning a river estuary varies with the time since midnight,  $t$  hours, and is given by  $h = 3.6 + 2.7 \sin\left(\frac{\pi t}{6}\right)$ .

(a) Sketch the graph of the clearance against time on the axes below. [3]



(b) Determine the percentage of any 24-hour period during which the clearance under the bridge is no more than two metres. [2]

8. (6 marks)

Consider the function  $f(t) = 2 \sin t - 5 \cos t$ ,  $t \geq 0$ .

(a) Express  $f(t)$  in the form  $r \sin(t - \alpha)$ , where  $r > 0$  and  $0 \leq \alpha \leq \frac{\pi}{2}$  and state the values of  $r$  and  $\alpha$ , rounded to 2 decimal places. [4]

(b) Hence or otherwise determine the minimum value of  $f(t)$  and the smallest value of  $t$  for this minimum to occur. [2]