# WILLETTON SENIOR HIGH SCHOOL

# YEAR 11
# MATHEMATICS METHODS
# TEST 1 – CALCULATOR FREE
# 2024

**STUDENT'S NAME:** MARKING KEY

**CIRCLE YOUR TEACHER'S NAME:**

**Mr Galbraith** **Mrs Gatland** **Mrs Kalotay** **Mr Lee**

**Mr Riemer** **Mrs Scoles** **Mrs Smirke** **Mrs Thompson**

**Working Time:** **25 minutes**

**Calculators are not permitted**

**Marks:** _____/30

**Question 1** **(2 marks)**

a) Convert $\frac{11\pi}{6}$ to degrees. [1]

$= \frac{11 \times 180^\circ}{6}$

$= 330^\circ$ ✓

b) Convert 240° to radians. [1]

$= 240^\circ \times \frac{\pi}{180^\circ}$

$= \frac{4\pi}{3}$ ✓

**Question 2** **(3 marks)**

Find the exact value of;

a) $\sin 150°$. $= \frac{1}{2}$ ✓ [1]

b) $\cos\frac{5\pi}{4}$. $= -\frac{\sqrt{2}}{2}$ ✓ [1]

c) $\tan(-60°)$. $= -\sqrt{3}$ ✓ [1]

**Question 3** **(3 marks)**

If $\sin 134° = 0.72$ and $\sin 136° = 0.69$, state the value of;

a) $\sin(-46°)$. $= -0.72$ ✓ [1]

b) $\sin(316°)$. $= -0.69$ ✓ [1]

c) $\sin(404°)$. $= 0.69$ ✓ [1]

**Question 4** **(2 marks)**

Determine all possible solutions for the following equation over the given domain;

$$\cos\theta = \frac{-1}{2}, \quad -180° \leq \theta \leq 180°$$

ref angle $= 60°$

Sol $-120°$ ✓ and $120°$ ✓

**Question 5** **(2 marks)**

Evaluate $\binom{12}{4}$.

$= \dfrac{12 \times 11 \times 10 \times 9}{4 \times 3 \times 2 \times 1}$ ✓

$= 495$ ✓

**Question 6** **(7 marks)**

a) Find the fourth term in the expansion of $(5 - 2x)^4$ if the terms are written in ascending powers of $x$. [2]

$= \binom{4}{3} \times 5 \times (-2x)^3$ ✓

$= 4 \times 5 \times (-8x^3)$

$= -160x^3$ ✓

b) Find the coefficient of $x^4$ in the expansion of $(3x - 2)^5$. [2]

$= \binom{5}{1} (3x)^4 (-2)$ ✓

$= 5 \times 81x^4 \times (-2)$

$= -810x^4$

$\therefore$ coefficient is $-810$ ✓

c) Find the constant term (term independent of $x$) in the expansion of $(2x^2 - \frac{1}{x})^3$. [3]

✓

$\binom{3}{2} (2x^2)^1 \left(-\frac{1}{x}\right)^2$ ✓

$= 3 \times 2x^2 \times \dfrac{1}{x^2}$

$= 6$ ✓

**Question 7** **(3 marks)**

Find the angle of inclination for the line $x + \sqrt{3}y + 4 = 0$.

$\sqrt{3}y = -x - 4$

$y = -\frac{1}{\sqrt{3}}x - \frac{4}{\sqrt{3}}$ ✓

$\tan\theta = -\frac{1}{\sqrt{3}}$ ✓

$\theta = 150^\circ$ or $\frac{5\pi}{6}$ ✓

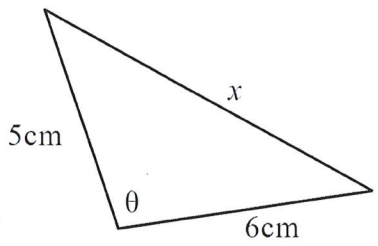
**Question 8** **(4 marks)**

a) Determine the value of $\theta$, given $\sin\theta = \frac{\sqrt{3}}{2}$, and $\theta$ is obtuse. [1]

ref angle $= 60^\circ$ or $\frac{\pi}{3}$

$\therefore \theta = 120^\circ$ or $\frac{2\pi}{3}$ ✓

b) Determine the exact value of $x$, using your value of $\theta$ from above. [3]




$x^2 = 5^2 + 6^2 - 2\times5\times6\cos\frac{2\pi}{3}$ ✓

$= 25 + 36 - 60(-\frac{1}{2})$ ✓

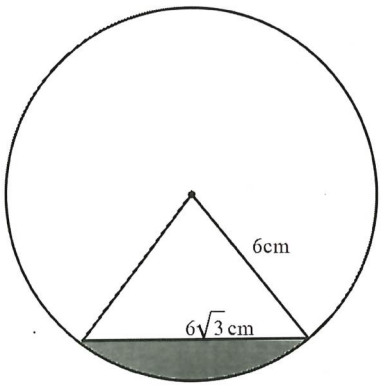
$= 61 + 30$

$= 91$

$x = \sqrt{91}$ cm ✓

**Question 9** **(4 marks)**

Find the exact area of the shaded segment below;




$$\cos\theta = \frac{6^2 + 6^2 - (6\sqrt{3})^2}{72} \checkmark$$

$$= \frac{36 + 36 - 108}{72}$$

$$= -\frac{36}{72} = -\frac{1}{2}$$

$$\therefore \theta = 120^\circ \text{ or } \frac{2\pi}{3} \checkmark$$

either/or

or

$$l = 2r\sin\frac{\theta}{2}$$

$$6\sqrt{3} = 2 \times 6 \sin\frac{\theta}{2} \checkmark$$

$$\frac{\sqrt{3}}{2} = \sin\frac{\theta}{2}$$

$$\therefore \frac{\theta}{2} = 60^\circ \text{ or } \frac{\pi}{3}$$

$$\therefore \theta = 120^\circ \text{ or } \frac{2\pi}{3} \checkmark$$

Area of segment $= \frac{1}{2}r^2(\theta - \sin\theta)$

$$= \frac{1}{2} \times 6^2 \left(\frac{2\pi}{3} - \sin\frac{2\pi}{3}\right) \checkmark$$

$$= 18\left(\frac{2\pi}{3} - \frac{\sqrt{3}}{2}\right)$$

$$= (12\pi - 9\sqrt{3}) \text{ cm}^2 \checkmark$$

**END OF CALCULATOR FREE**

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# YEAR 11
# MATHEMATICS METHODS
# TEST 1 – CALCULATOR ALLOWED
# 2024

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**Mr Galbraith** **Mrs Gatland** **Mrs Kalotay** **Mr Lee**

**Mr Riemer** **Mrs Scoles** **Mrs Smirke** **Mrs Thompson**

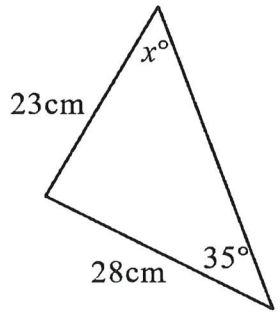
**Working Time:** **25 minutes**

**Calculators and/or Classpads are permitted.**
**One page of notes, one side only.**

**Marks:** _____ / 22

**Question 10** **(3 marks)**

Determine the value of $x$ in the diagram below.




$$\frac{\sin x}{28} = \frac{\sin 35}{23} \checkmark$$

$$\sin x = \frac{28 \sin 35}{23}$$

$$x = \sin^{-1}\left(\frac{28 \sin 35}{23}\right) = 0.69826697$$

$$= 44.288$$

$$\therefore x = 44.29^\circ \checkmark \text{ or } 135.71^\circ \checkmark$$

**Question 11** **(7 marks)**

Cynthia decides to have a get together for some friends at her new house. She has 12 close friends, but only room for eight friends around her new dining table. Of her close friends, four of them are friends of hers from high school.

In how many ways may she choose the eight guests from her twelve friends if;

a) there are no restrictions. [1]

$$\binom{12}{8} = 495 \checkmark$$

b) at most two friends from high school may be chosen. [3]

$$\binom{4}{0}\binom{8}{8} + \binom{4}{1}\binom{8}{7} + \binom{4}{2}\binom{8}{6}$$

$$= 1 \times 1 + 4 \times 8 + 6 \times 28$$

$$= 1 + 32 + 168$$

$$= 201 \checkmark$$

or ✓✓ one for each one stated correct and calculated correctly. Then subtract one if total not correct.

c) If her friend Julie and her friend Blake will not attend together. [3]

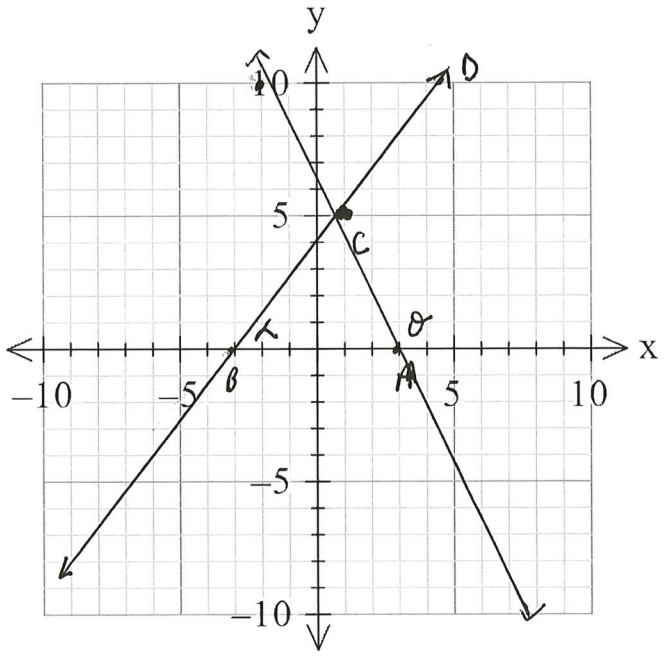
$$\binom{2}{0}\binom{10}{8} + \binom{1}{0}\binom{1}{1}\binom{10}{7} + \binom{1}{1}\binom{1}{0}\binom{10}{7}$$

$$= 45 + 120 + 120$$

$$= 285 \checkmark$$

**Question 12** **(6 marks)**

By graphing each of the following, find the size of the obtuse angle in degrees between them where $y = -2x + 6$ and $3y - 4x = 12$.




$\tan\theta = -2$ ✓

$\theta = 116.57°$

$\therefore s\angle BAC = 63.43\ (63.4349)$ ✓

$3y - 4x = 12$

$3y = 4x + 12$

$y = \frac{4}{3}x + 4$

$\tan\alpha = \frac{4}{3}$ ✓

$\therefore \alpha = 53.13°\ (53.1301)$

$\therefore s\angle ABC = 53.13°$ ✓

$\therefore s\angle BCA = 180° - 63.4349° - 53.1301°$

$= 63.4349°$

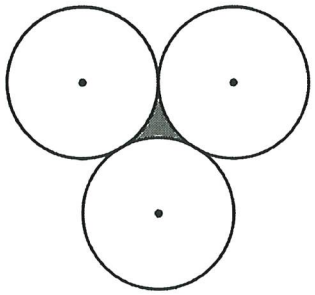
$\therefore s\angle ACD = 180° - 63.4349°$

$= 116.565051$

$= 116.57°$ ✓

**Question 13** **(6 marks)**

Three circles each of radius 10 cm touch each other externally.



Determine;

a) the perimeter of the shaded area as an exact value. [2]

$l = r\theta$

$= 10 \times \frac{\pi}{3}$

$= \frac{10\pi}{3}$ cm ✓

$\therefore$ Perimeter $= 3 \times \frac{10\pi}{3} = 10\pi$ cm ✓

b) the shaded enclosed area between them as an exact value. [4]

Area of triangle $= \frac{1}{2} ab \sin C$

$= \frac{1}{2} \times 20 \times 20 \sin \frac{\pi}{3}$ ✓

$= \frac{1}{2} \times 400 \times \frac{\sqrt{3}}{2}$

$= 100\sqrt{3}$ cm$^2$ ✓

Area of sector $= \frac{1}{2} r^2 \theta$

$= \frac{1}{2} \times 10^2 \times \frac{\pi}{3}$

$= \frac{50\pi}{3}$ cm$^2$ ✓

or $\frac{\theta}{360} \times \pi r^2$

$= \frac{60}{360}^\circ \times \pi \times 10^2$

$= \frac{50\pi}{3}$ cm$^2$ ✓

$\therefore$ Shaded area $= \left(100\sqrt{3} - 3 \times \frac{50\pi}{3}\right)$ cm$^2$

$= (100\sqrt{3} - 50\pi)$ cm$^2$ ✓ Must be exact

**END OF CALC ASSUMED**