

Chapter 2 Test

1. Expand and simplify the following (3K marks)

$$\begin{aligned}(2x - y - 2)^2 &= (2x - y - 2)(2x - y - 2) \\ &= 4x^2 + y^2 + 4 - 4xy + 4y - 8x\end{aligned}$$

2. Factor each of the following expressions **completely**: (no expanding) (2K marks each)

a. $8x^4 - 50y^6$
 $= 2(4x^4 - 25y^6)$
 $= 2(2x^2 - 5y^3)(2x^2 + 5y^3)$

b. $12x^2 - 10x - 8$
 $= 2(6x^2 - 5x - 4)$
 $= 2(3x - 4)(2x + 1)$

c. $8(2c - b) - c(b - 2c)$
 $= 8(2c - b) + c(2c - b)$
 $= (2c - b)(8 + c)$

d. $x^2 - 14xy + 48y^2$
 $= (x - 8y)(x - 6y)$
 $= (y - 5 - 4 + x)(y - 5 + 4 - x)$
 $= (y - 9 + x)(y - 1 - x)$

3. Simplify each of the following. State and classify all restrictions (3K marks)

$$\begin{aligned}\frac{2m^2 - mn - n^2}{4m^2 - 4mn - 3n^2} &= \frac{(2m+n)(m-n)}{(2m+n)(2m-3n)} \quad m \neq -\frac{n}{2} \text{ (H)} \\ &= \frac{m-n}{2m-3n} \quad m \neq \frac{3n}{2} \text{ (A)}\end{aligned}$$

4. Simplify the following. (State and classify restrictions) (a/b: 4K marks each) (c: 6A marks)

a. $\frac{x^4 - 1}{x^2 - 2x + 1} * \frac{x - 1}{x^2 + 2x + 1}$
 $= \frac{(x^2 + 1)(x^2 - 1)}{(x-1)^2} * \frac{(x-1)}{(x+1)}$
 $= \frac{x^2 + 1}{x+1} \quad x \neq 1 \text{ (H)}$
 $\quad x \neq -1 \text{ (AS.)}$

b. $\frac{ab^2 + 2}{2ab^2} - \frac{b+2}{2b}$
 $= \frac{(ab^2 + 2)(2b) - (b+2)(2ab^2)}{(2ab^2)(2b)}$
 $= \frac{2ab^3 + 4b - 2ab^3 - 4ab^2}{(2ab^2)(2b)}$
 $= \frac{4b - 4ab^2}{(2ab^2)(2b)}$

c. $\left(\frac{x^2 + 5x + 6}{x^2 - 3x + 2} / \frac{x+3}{x-1} - \frac{6}{x+3} \right)$
 $= \left[\frac{(x+3)(x+2)}{(x-2)(x-1)} * \frac{x+3}{x-1} - \frac{6}{x+3} \right] \quad x \neq 2 \text{ (AS.)}$
 $= \frac{(x+3)(x+2)(x-1)}{(x-2)(x-1)(x+3)} - \frac{6}{x+3} \quad x \neq -3 \text{ (AS.)}$
 $= \frac{(x+3)(x+2)(x-1)}{(x-2)(x-1)(x+3)} - \frac{6(x-2)}{(x-2)(x+3)}$
 $= \frac{x^2 + 5x + 6 - 6x + 12}{(x-2)(x+3)}$
 $= \frac{x^2 - x + 18}{(x-2)(x+3)}$

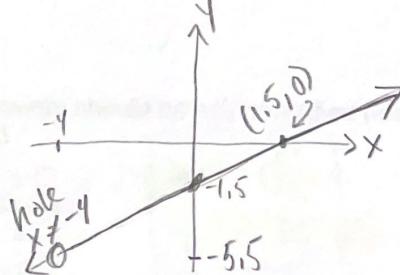
5. $y = \frac{2x^2 + 5x - 12}{2x + 8}$

- a) Simplify the expression, state and classify restrictions. (3K marks)

$$\begin{aligned}y &= \frac{(2x-3)(x+4)}{2(x+4)} \\ &= \frac{2x-3}{2} \quad x \neq -4 \text{ (Hole)}\end{aligned}$$

- b) Draw the graph of the function (2A marks)

Sketch



- c) Clearly label asymptote(s) and/or hole(s) (1C marks)

OK

$$A = \frac{1}{2}bh$$

6. Determine the area of a triangle with base: $\frac{9y^2-4}{4y-12}$ and height: $\frac{18-6y}{9y^2+12y+4}$. State and classify any restrictions.

$$\begin{aligned} A &= \frac{1}{2} \left(\frac{9y^2-4}{4y-12} \right) \left(\frac{18-6y}{9y^2+12y+4} \right) \\ &= \frac{6(3y+2)(3y-2)(3-2)}{-12(y-3)(3y+2)(3y+2)} \end{aligned}$$

$= \frac{3y-2}{-2(3y+2)}$

$y \neq -\frac{2}{3} \text{ (as.)}$

HARD
7. Rewrite $\frac{3}{x^2-x-2}$ as a sum or difference of two rational expressions with DIFFERENT bases and solve it show it equals the expression given (2T marks)

$$\begin{aligned} \frac{3}{x^2-x-2} &= \frac{3}{(x-2)(x+1)} \\ &= \frac{A}{(x-2)} + \frac{B}{(x+1)} \\ &= \frac{A(x+1) + B(x-2)}{(x-2)(x+1)} \end{aligned}$$

$= A(x+1) + B(x-2) = 3$

let $x=-1$ let $x=2$
 $B(-3) = 3$ $A(3) = 3$
 $B = -1$ $A = 1$

$\frac{1}{(x-2)} - \frac{1}{(x+1)}$

PROOF
 $LS = \frac{3}{x^2-x-2}$
 $LS = RS$
 $RS = \frac{1}{x-2} - \frac{1}{x+1}$
 $= \frac{x+1-x+2}{(x+2)(x+1)}$
 $= \frac{3}{(x^2-x-2)}$

Communication (4C marks) - marks are awarded for proper units and form from throughout the test.

Chapter 3 Test

1. Fill in the blank (12C marks)

a. Given the following quadratic $y = x^2 + 6x - 2$

a. Domain: $D = \mathbb{R}$

b. Range: $R = \{y \in \mathbb{R} \mid y \geq -11\}$

c. Vertex: $(-3, -11)$

d. Direction of opening: up

e. Axis of symmetry: $x = -3$

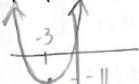
f. Current form the quadratic is given in is called:

standard form

g. Number of zeros: $D = b^2 - 4ac = 36 - 4(1)(-2)$

$$D > 0 \therefore 2 \text{ ZEROS}$$

h. Sketch the graph (include: opening, approx.vertex)



2. Simplify the following (3K marks)

$$\begin{aligned} \sqrt{2}(2\sqrt{8} - 3\sqrt{32} + 4\sqrt{50}) &= \sqrt{2}(4\sqrt{2} - 12\sqrt{2} + 20\sqrt{2}) \\ &= \sqrt{2}(12\sqrt{2}) \\ &= 12(2) \\ &= 24 \end{aligned}$$

3. Solve by expanding and factoring (4K marks) $(x+3)(x+5) = 3(x+7)$

$$\left. \begin{array}{l} x^2 - 2x - 15 - 3x - 21 = 0 \\ x^2 - 5x - 36 = 0 \\ (x-9)(x+4) = 0 \end{array} \right\} X = 9, -4$$

4. Find the x-intercepts using the quadratic formula. Answers should be fully simplified (reduced radical form if applicable) (4K marks) $y = x^2 - 4x + 1$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{4 \pm \sqrt{16 - 4(1)(1)}}{2(1)}$$

$$x = \frac{4 \pm \sqrt{12}}{2}$$

$$x = \frac{4 \pm 2\sqrt{3}}{2}$$

$$x = 2 \pm \sqrt{3}$$

$$\boxed{\begin{array}{l} x_1 = 2 + \sqrt{3} \\ x_2 = 2 - \sqrt{3} \end{array}}$$

5. Determine the point(s) of intersection of the parabola $y = 2x^2 + 12x + 10$ and the line $y = 4x + 2$ (5T marks)

$$\begin{array}{l} \textcircled{1} \quad y = 2x^2 + 12x + 10 \quad \text{sub } y \text{ into } \textcircled{1} \\ \textcircled{2} \quad y = 4x + 2 \quad 2x^2 + 12x + 10 = 4x + 2 \\ \quad \quad \quad 2x^2 + 8x + 8 = 0 \\ \quad \quad \quad 2(x^2 + 4x + 4) = 0 \\ \quad \quad \quad 2(x+2)^2 = 0 \\ \boxed{x = -2} \end{array}$$

$$\begin{array}{l} \text{sub } x \text{ into } \textcircled{2} \\ y = 4(-2) + 2 \\ y = -8 + 2 \\ \boxed{y = -6} \end{array}$$

∴ The P.O.I.
is $(-2, -6)$.

6. A rectangle has an area of 60m^2 . One side is 7m longer than the other. What are the dimensions of the rectangle? You must set up and solve the equation for full marks. (5A marks)

Let s represent a side (m)

$$\begin{array}{l} \textcircled{1} \quad 60 = (s+7)s \quad \because -12 \text{ is invalid} \\ 0 = s^2 + 7s - 60 \\ 0 = (s+12)(s-5) \\ s = -12, 5 \end{array}$$

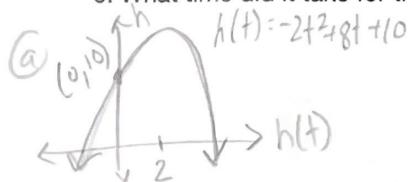
\therefore The dims are $5\text{m} \times 12\text{m}$

7. A ball is thrown off the roof of the school. Its path can be described by the equation $h(t) = -2t^2 + 8t + 10$ where h is the height in meters after t seconds.

a. Sketch (1C mark)

b. What height was the ball thrown from? Show your work. (1A mark)

c. What time did it take for the ball to reach max height? Show your work. (3A marks)



$$\begin{array}{l} \textcircled{5} \quad h(t) = -2t^2 + 8t + 10 \\ = -2(t^2 - 4t) + 10 \\ = -2(t-2)^2 + 10 + 8 \\ = -2(t-2)^2 + 18 \\ V(2, 18) \end{array}$$

\therefore It took 2 seconds to reach max height

⑥ $h(t) = -2t^2 + 8t + 10$

y-int: $(0, 10)$

\therefore The ball was thrown from 10m .

Communication (4C marks) - marks are awarded for proper form, units, etc. from throughout the test.

BONUS: (1) Determine the value(s) of k such that the following quadratic has one x-int. $(x^2 - 1)k = (x - 1)^2$

$\boxed{k=0}$

PROOF

$$\begin{array}{l} x^2 - 2x + 1 - kx^2 + k = 0 \\ x^2(1-k) - 2x + 1 + k = 0 \end{array}$$

$\underbrace{a}_{x^2}, \underbrace{b}_{-2x}, \underbrace{c}_{1+k}$

$$\begin{aligned} D &= b^2 - 4ac \\ 0 &= b^2 - 4ac \\ 0 &= (-2)^2 - 4(1-k)(1+k) \\ 0 &= 4 - 4 + 4k^2 \\ 0 &= 4k^2 \\ 0 &= k^2 \\ \boxed{k=0} \end{aligned}$$

SKIPPED

Chapter 4 Test

Fill in the blank (8 K marks)

A. What is the domain of the function $y = -2^{x-1} + 3$ _____

B. What is the range of the function $y = -3 * 2^{2x} - 1$ _____

C. Evaluate $\sqrt[4]{-8y^9x^6y^0}$

D. Evaluate $-27^{-\frac{2}{3}}$

E. Evaluate $32^{\frac{3}{5}}$

F. Convert to simplified radical form: $(24yx^3)^{-\frac{1}{2}}$

G. Given $f(x) = 3^{-x+1} - 2$ state the value of $a = \underline{\hspace{2cm}}$, $k = \underline{\hspace{2cm}}$, $c = \underline{\hspace{2cm}}$, $d = \underline{\hspace{2cm}}$

1. Power Laws. Express with NO NEGATIVE OR FRACTIONAL exponents (3K marks each)

a.

$$\sqrt[3]{\frac{x\sqrt{x^6y}\sqrt{x}}{x^{\frac{3}{2}}}}$$

b.)

c.) Evaluate the ratio of $200A = \underline{\hspace{2cm}}$

2. For the function: $f(x) = -3^{-2x+1} - 2$, given the parent function, state all of the transformations using proper terminology from class. (4C marks)

3. Solve for x. (2K marks each)

a. $26 = -1 + (-9x)^{\frac{3}{4}}$

b. $x = \sqrt{7 + \sqrt[3]{6 + \sqrt[3]{3 + \sqrt[3]{1}}}}$

4. Solve for x for each of the following. (3T mark each)

a.

$$\left(\frac{1}{6}\right)^{3x+2} * 216^{3x} = \frac{1}{216}$$

b.

$$40(2^{x+2}) = 5$$

c.

$$3^{2x} - 4(3^x) + 3 = 0$$

5. Graph the following function. Show your work. Simplify first to make it easier! Correctly draw all transformed graphs (5A marks)

$$f(x) = -2^{x-1} + 3$$

6. Evaluate the following exactly: (3T marks)

a. $0.04^{\frac{1}{2}}$

b. $\sqrt[3]{729}$

c. $81^{0.75}$

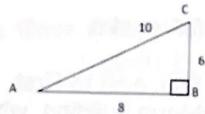
(4C marks) - marks are awarded for proper form, units etc from throughout the test.

Bonus (1 bonus mark) Determine the value of x such that $12^{2x+1} = (2^{3x+7})(3^{3x-4})$

Chapter 5 Trig Test 1

1. Fill in the blank (10K marks)
 - i. Given 3 sides on an acute triangle use Cosine law to solve the triangle
 - ii. What is the reciprocal ratio of sine? $\csc \theta = \frac{\text{hyp}}{\text{opp}} = \frac{1}{\sin \theta}$
 - iii. What is the range of the $y = \sin x$ graph? $R = \{y \in \mathbb{R} \mid -1 \leq y \leq 1\}$
 - iv. The angle from your sight line to an object above you is called angle of elevation
 - v. How many possible triangles can be made if you are given side $m = 9.3$, $n = 7.2$ and $\angle N = 35^\circ$? two
 - vi. How many possible triangles can be made if you are given side $c = 3$, $d = 4$ and $\angle D = 70^\circ$? one

vii.



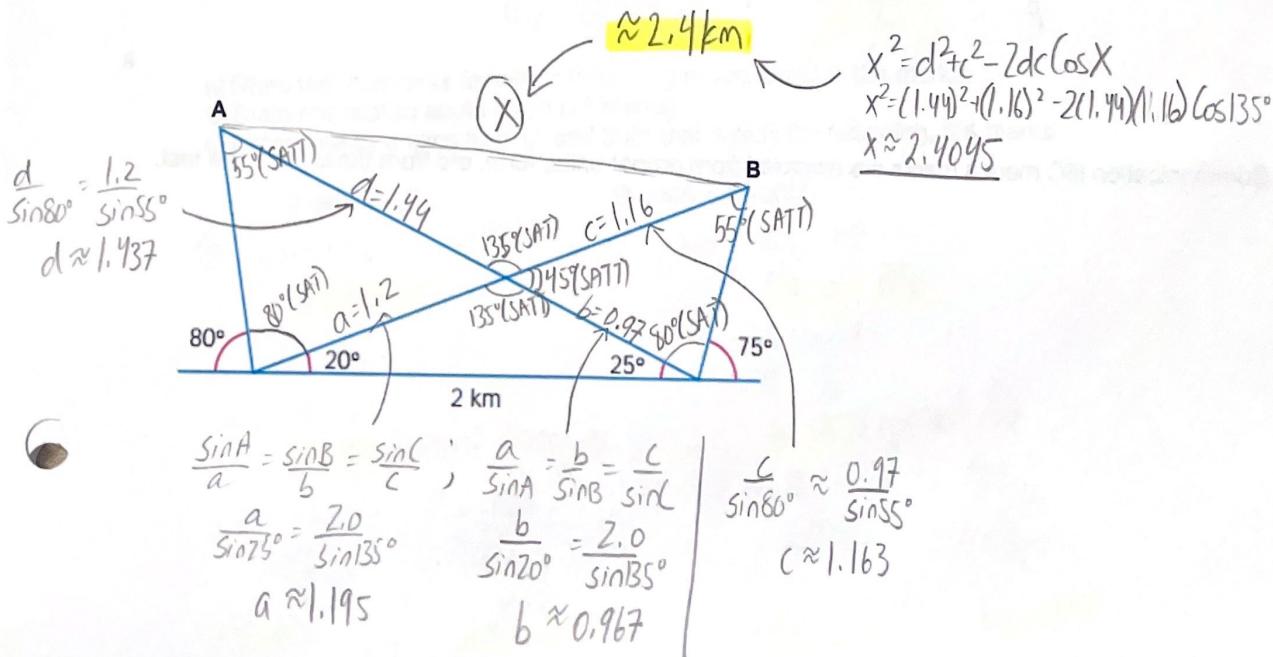
- a) What is the length of the side adjacent C? 6

b) Evaluate the ratio of $\csc C = \frac{1}{\sin C} = \frac{1}{4/\sqrt{5}} = \frac{\sqrt{5}}{4}$

c) Evaluate the ratio of $\sec A = \frac{1}{\cos A} = \frac{1}{1/\sqrt{5}} = \frac{\sqrt{5}}{1}$

d) What is the value of angle C? $\sin C = 4/5$
 $C \approx 53^\circ$

2. Find x. Show all steps and reasoning for full marks (8T mars)

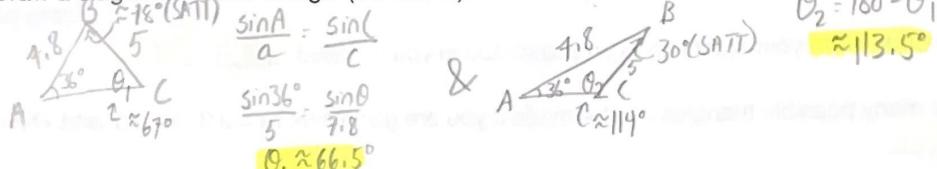


3. Given triangle ABC if $a = 5\text{m}$, $c = 7.8$ and $\angle A = 36^\circ$:

a) Prove that 2 possible triangles can be drawn. Show work to support your answer (2T marks)

$$\begin{aligned} LS &= a \\ &= 5 \end{aligned} \quad \begin{aligned} RS &= c \sin A \\ &= 7.8 \sin 36^\circ \\ &\approx 4.58 \end{aligned} \quad \begin{aligned} &\because LS > RS \text{ & } a < c \\ &\therefore 2 \text{ solutions.} \end{aligned}$$

b) Draw a diagram of each triangle (2C marks)

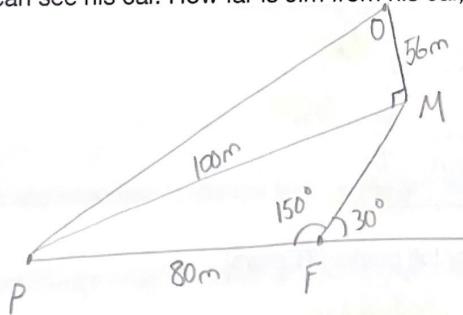


c) Find sides AC on both triangles (7K marks)

$$\begin{aligned} \frac{b}{\sin B} &= \frac{a}{\sin A} \\ \frac{b}{\sin(77.52^\circ)} &= \frac{5}{\sin 36^\circ} \quad \Delta_1 \qquad \frac{b}{\sin B} = \frac{a}{\sin A} \\ b \approx 8.305 & \qquad \qquad \qquad \frac{b}{\sin(30.48^\circ)} = \frac{5}{\sin 36^\circ} \quad \Delta_2 \\ b \approx 4.315 & \end{aligned}$$

4. DRAW AND LABEL DIAGRAM ONLY for the following problem. Do not solve (3A marks).

Jim parks his car in a lot on the corner of Park Lane and Main Street. He walks 80m east to First Avenue, turns 30 degrees to the left and follows First Avenue for 100m into the Metro building, where he takes the elevator to his office on the 15th floor. Each floor in the building is 4m in height. From his office window, he can see his car. How far is Jim from his car, in a direct line?



Communication (5C marks) marks are awarded from proper units, form, etc from throughout the test.

NO CALCULATORS

Chapter 5 Trig Test 2

1. Fill in the blank (16T marks)

a. $\cot X = -2$ so X is located in quadrants Q2 or Q4

b. An angle with a clockwise rotation is called negative

c. Find a co-terminal angle for 140° . 500°

d. The principal angle of 620° is 260°

e. Given $\tan x = 0$ and x is from 0° to 260° the possible values for x are: $0^\circ, 360^\circ, 180^\circ$

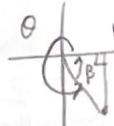
f. Given $\tan x = \frac{-1}{\sqrt{3}}$ then $x = \frac{\pi}{6}$, $y = -1$ and $r = 2$ $\tan \theta = \frac{-1}{\sqrt{3}}$ $\therefore \tan \theta = \frac{y}{x} \therefore y = -1, x = \sqrt{3}$ $\sqrt{3+1} = \sqrt{4} = 2$

g. Given $\sin x = 1/5$ and $\cos x = 2/5$ then is $\tan x$ positive or negative? positive

h. State the related acute angle of 150° 30° $\beta = 180^\circ - \theta$ $\beta = 30^\circ$

i. Given $x = 700^\circ$ then $\beta = \frac{20^\circ}{}$

j. Given $P(1, -1)$ is a point on a terminal arm: (4T marks)
 i. $\tan \theta = \frac{y}{x} = -1$ ii. $\tan \beta = |\tan \theta| = 1$ iii. θ is in quadrant 4 iv. $\beta = 45^\circ$ (special Δ)



2. Evaluate the following: (6K marks)

i. $\sec 330^\circ = \frac{1}{\cos 30^\circ} = \frac{2\sqrt{3}}{3}$ iv. $\cos 720^\circ = \frac{1}{}$

ii. $\csc 210^\circ = \frac{1}{\sin 210^\circ} = -2$ v. $\csc 180^\circ = \frac{1}{\sin 180^\circ} = \infty$

iii. $\tan 135^\circ = \frac{\tan 45^\circ}{-1} = -1$ vi. $\sin(-30^\circ) = \frac{\sin 330^\circ}{-1} = -\frac{1}{2}$

3. State the exact value and simplify fully into a single fraction: (4K marks)

$$\begin{aligned} \cos 210^\circ + \sqrt{3} \sec 135^\circ &= -\cos 30^\circ + \sqrt{3} \left(\frac{1}{-\cos 45^\circ} \right) = -\frac{\sqrt{3}}{2} - \frac{2\sqrt{6}}{2} \\ &= -\frac{\sqrt{3}}{2} + \sqrt{3} \left(-\frac{1}{\sqrt{2}} \right) = -\frac{\sqrt{3} - 2\sqrt{6}}{2} \\ &= -\frac{\sqrt{3}}{2} - \frac{\sqrt{6}}{2} \end{aligned}$$

4.

a) State the quadrants for which those angles are found in (2A marks)

b) State the related acute angle (2T marks)

c) Determine all angles from 0° and 360° that satisfy the following. (2K marks)

I) $\tan x = -\sqrt{3}$

(a) $\because \tan x < 0$
 $\therefore Q2 \text{ and } Q4$

II) $\cos A = 1/\sqrt{2}$

(a) $\because \cos A > 0$
 $\therefore Q1 \text{ or } Q4$

(b) $\tan \beta = |\tan x|$
 $\tan \beta = \sqrt{3}$
 $\beta = 60^\circ$ (special triangle)

(b) $\cos \beta = |\cos A|$
 $\cos \beta = \frac{1}{\sqrt{2}}$
 $\beta = 45^\circ$ (special Δ)

(c) In Q2
 $\theta_1 = 120^\circ$

In Q4
 $\theta_2 = 300^\circ$

(c) In Q1
 $\theta_1 = 45^\circ$

In Q4
 $\theta_2 = 315^\circ$

5. One of the primary trig ratios is given, as well as the quadrant in which the angle is located. Determine an exact expression for the other two primary trig ratios $\cos A$ and $\tan A$.

$$\sin A = \frac{-2}{\sqrt{6}}, \text{ third quadrant (4T marks)}$$

$$\begin{aligned} \therefore \sin A &= \frac{y}{r} & x^2 + y^2 &= r^2 \\ \therefore y &= -2, r = \sqrt{16} & x^2 + 4 &= 16 \\ & & x^2 &= 12 \\ \therefore A \in Q3 & & x &= \pm \sqrt{12} \\ \therefore x &= -\sqrt{2} & & \end{aligned}$$



$$\begin{aligned} \cos A &= \frac{x}{r} = \frac{-\sqrt{2}}{\sqrt{6}} = \frac{-\sqrt{12}}{6} = \frac{-2\sqrt{3}}{6} = \frac{-\sqrt{3}}{3} \\ \tan A &= \frac{y}{x} = \frac{-2}{-\sqrt{2}} = \frac{2\sqrt{2}}{2} = \sqrt{2} \end{aligned}$$

6. Prove that $(\sin \theta + \cos \theta)^2 + (\sin \theta - \cos \theta)^2 = 2$ (4T marks)

$$\begin{aligned} LS &= (\sin \theta + \cos \theta)^2 + (\sin \theta - \cos \theta)^2 & RS &= 2 \\ &= \sin^2 \theta + 2\sin \theta \cos \theta + \cos^2 \theta + \sin^2 \theta - 2\sin \theta \cos \theta + \cos^2 \theta & \therefore LS = RS \\ &= 2\sin^2 \theta + 2\cos^2 \theta & \therefore (\sin \theta + \cos \theta)^2 + (\sin \theta - \cos \theta)^2 = 2 \\ &= 2(\sin^2 \theta + 1 - \sin^2 \theta) \\ &= 2\sin^2 \theta + 2 - 2\sin^2 \theta \\ &= 2 \end{aligned}$$

7. Prove that $\frac{\cos X}{\sin X} - \tan X = \frac{2 \cos^2 X - 1}{\sin X \cos X}$. (4T marks)

$$\begin{aligned} LS &= \frac{\cos X}{\sin X} - \tan X \\ &= \frac{\cos X}{\sin X} - \frac{\sin X}{\cos X} \\ &= \frac{\cos^2 X - \sin^2 X}{\sin X \cos X} \\ &= \frac{(1 - \sin^2 X) - \sin^2 X}{\sin X \cos X} \\ &= \frac{(1 - 2\sin^2 X)}{\sin X \cos X} \end{aligned}$$

$$\begin{aligned} RS &= \frac{2\cos^2 X - 1}{\sin X \cos X} \\ &= \frac{2(1 - \sin^2 X) - 1}{\sin X \cos X} \\ &= \frac{2 - 2\sin^2 X - 1}{\sin X \cos X} \\ &= \frac{1 - 2\sin^2 X}{\sin X \cos X} \end{aligned}$$

$$\therefore LS = RS$$

$$\therefore \frac{\cos X}{\sin X} - \tan X = \frac{2\cos^2 X - 1}{\sin X \cos X}$$

Communication (4C marks) - marks are awarded for proper communication from throughout the test.

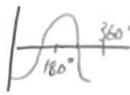
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Chapter 6 Test

Fill in the blank: (2C marks each) (20 marks)

1. If the axis is 3 and the amplitude is 3 of a sine graph then the equation of the max is 6 and the min is 0

2. A periodic function $f(x)$ has a period of 4 and $f(14) = -5$. Given that p is not 14, give 2 examples of p such that $f(p) = -5$.
 $p = \underline{18}$ or $p = \underline{10}$ period = 4, $f(14) = -5$

3. Given a negative cosine function is the interval from 0° to 360° , the x-intercept(s) is (are) $\underline{(90^\circ, 0)}$ & $\underline{(270^\circ, 0)}$ (points) and the maximum is at $\underline{(180^\circ, 1)}$ (points). 

4. Given $y = \sin 4x$ the amplitude of the function is 1 and the axis is $y = 0$

5. Given $y = 2\cos(2/3)x + 2$ the period of the function is 180° and the axis is $y = 2$

6. A cosine function has a minimum at $(3, 0)$, a period of 360° and axis of $y = 5$. What is a possible equation for this function?

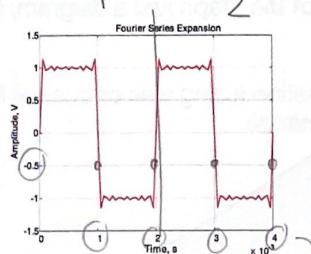
$$-5\cos(x-3^\circ)+5 ?$$

7. Given the function $y = 2\cos(x-90)$ a sine graph of the same function is $y = 2\sin(x-45^\circ)$,

8. Given a graph starts at a min $(0, 0)$, has a period of 90° and has a max of 2. Write a possible equation $y = -2\cos 4x$

9. Given $f(x) = 3\sin 90(x-75^\circ) + 2$ the domain is \mathbb{R} and the range is $\{y \in \mathbb{R} \mid -1 \leq y \leq 5\}$
 axis: $y = 2$] max = axis + amp = 5
 amp = 3] min = axis - amp = -1

10. Given the periodic function on the right:



Name 4 x-values (approx) that have a y-value of -0.5 1, 2, 3, 4
 What is the period? 2

11. Given the following function, $f(x) = -2\cos(2x-180^\circ)$ $= -2\cos(2(x-90^\circ))$

a. Fill in the following: (4K marks)

$$\text{Amp} = |a| = 2$$

$$\text{Axis} = c = 0$$

$$\text{Max} = 2$$

$$\text{Min} = -2$$

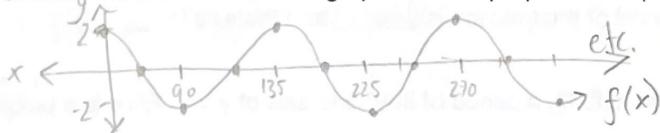
$$\text{Period} = \frac{360^\circ}{2} = 180^\circ$$

$$\text{Shift} = d = 90^\circ \text{ (right)}$$

Key points: _____

$$\begin{array}{ll} x_1 = 90^\circ & y_1 = \min = -2 \\ x_2 = 135^\circ & y_2 = \text{axis} = 0 \\ x_3 = 180^\circ & y_3 = \max = 2 \\ x_4 = 225^\circ & y_4 = \text{axis} = 0 \\ x_5 = 270^\circ & y_5 = \min = -2 \end{array}$$

b. Draw ONE CYCLE of the graph. Include proper labels (3C Marks)



12. Write a function to represent the motion of a point on a water wheel. The shell has a radius of 2m and the wheel rotates every 30 secs and the bottom of the wheel is 0.6 below water level. Given the water surface is the x-axis and the function starts at a min, determine an equation of the function:

~~+ sine~~ A using sine: $y = 2\sin(\pi(x-7.5)) + 1.4$ (2A marks)

~~- cosine~~ A using cosine: $y = -2\cos(\pi x) + 1.4$ (2A marks)

$$\left. \begin{array}{l} \text{amp} = c = 2 \\ \text{axis} = y = \frac{3.4 - 0.6}{2} = 1.4 \\ \text{max} = 3.4 \\ \text{min} = -0.6 \\ \text{period} = 30 \text{ s}, k = \frac{360^\circ}{P} = \frac{360^\circ}{30} = 12 \end{array} \right\} \begin{array}{l} a = 2 \\ c = 1.4 \\ d = 0 \\ k = 12 \end{array}$$

13. A Ferris wheel is 4 feet off the ground. It has a diameter of 26 feet, and rotates once every 32 seconds. If you begin the ride sitting in a chair at the bottom of the ride.....

a. Draw a labeled sketch (not the graph just a diagram) (2C marks)

~~No~~

b. Write a trigonometric equation (using sine or cosine) for your height above the ground at t seconds after the ride starts. (3A marks)

c. How high will you be 10 seconds into the ride? Show your work for full marks and write your answer in reduced radical form. (3A marks)

d. During the first rotation, when will you be 10.5 feet high? (Hint: this happens twice) (4A marks)

Communication (3C marks) - marks are awarded for proper use of units, form, etc. from throughout the test.

BONUS (1 bonus mark)

A sine function has a maximum value of 11, a minimum value of -1, a phase shift of $2x/3$ rad to the left, and a period of pi. Write an equation for the function.

- No
1. Simplify $\frac{1}{\sqrt{3}} + \frac{1}{\sqrt{2}} i$. Show all work. (1 mark)
 2. The first three terms of the sequence defined by $a_1 = 1$ and $a_n = \frac{1}{2}a_{n-1}$ are 1, $\frac{1}{2}$, and $\frac{1}{4}$. Find the sum of the first 10 terms of the sequence. (1 mark)
 3. Find the sum of the series $3 + 6 + 9 + \dots + 37$ (3 marks)
 4. An arithmetic sequence has a sum of 104. Determine the first term of the sequence if the common difference is 3 and the last term is 20. (3 marks)
 5. Given the following ratios: $2 : 8 = 6 : x$ and the value of the term is 143. Find the number of terms in the ratio. (3 marks)
 6. Complete the next 4 rows of Pascal's triangle. (3 marks)

1. $\frac{1}{\sqrt{3}} + \frac{1}{\sqrt{2}} i$
2. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots + \frac{1}{2^{10}}$
3. $3 + 6 + 9 + \dots + 37$
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$$I = PRT$$

$$A = P(1+i)^n$$

Seq. $t_n = a + (n-1)d$ Series $S_n = \frac{1}{2} [2a + (n-1)d]$	Arithmetic Geometric $t_n = ar^{n-1}$ $S_n = \frac{a(r^n - 1)}{r-1}$
---	---

Sequences and Series Quiz

All solutions must have proper mathematical support. A grade of zero will be awarded for trial and error solutions.

NO CALCULATORS

1. How many terms are in the sequence 2, 7, 12, 17, ..., 102? (3K marks)

$$\begin{array}{l} a=2 \\ d=5 \end{array} \quad \begin{array}{l} 2, 7, 12, 17, \dots, 102 \\ \uparrow \\ +5 \end{array} \quad \begin{array}{l} t_n = a + (n-1)d \\ 102 = 2 + (n-1)5 \\ 102 = (n-1)5 \\ 102 = 5(n-1) \end{array} \quad \therefore \text{There are } 21 \text{ terms.}$$

2. The first three terms of the sequence defined by $t_1 = 4$, $t_n = 2t_{n-1} + 3$, are (3K marks)

$$\begin{array}{l} t_1 = 4 \\ t_2 = 2(4) + 3 = 11 \\ t_3 = 2(11) + 3 = 25 \end{array} \quad \begin{array}{l} t_n = 2t_{n-1} + 3 \\ \left[\begin{array}{l} t_1 = 4 \\ t_2 = 11 \\ t_3 = 25 \end{array} \right] \end{array} \quad \therefore \text{The first 3 terms are } 4, 11, 25.$$

3. Find the sum of the series $3 + 4 + 5 + \dots + 97$ (4T marks)

$$\begin{array}{l} a=3 \\ d=1 \end{array} \quad \begin{array}{l} 3+4+5+\dots+97 \\ \uparrow \\ +1 \end{array} \quad \begin{array}{l} S_n = \frac{n}{2} [2a + (n-1)d] \\ S_{95} = \frac{95}{2} [2(3) + 94(1)] \\ S_{95} = \frac{95}{2} [6 + 94] = 4750 \end{array} \quad \begin{array}{l} t_n = a + (n-1)d \\ 97 = 3 + (n-1)1 \\ 97 = 3 + n-1 \\ 94 = n-1 \\ n = 95 \end{array} \quad \begin{array}{l} \therefore \text{The sum} \\ \text{of the series} \\ \text{is } 4750 \end{array}$$

4. For an arithmetic sequence $t_7 = 53$ and $t_{11} = 97$. Determine a , d , t_n and t_{50} for this sequence. (5T marks)

$$\begin{array}{l} \text{arithmetic} \\ \left\{ \begin{array}{l} t_7 = 53 \\ t_{11} = 97 \end{array} \right. \end{array} \quad \begin{array}{l} t_n = a + (n-1)d \\ t_7 = a + 6d \\ t_{11} = a + 10d \\ t_{11} = a + 4d \\ \boxed{t_{11} = 4d} \end{array} \quad \begin{array}{l} t_{50} = -24 + 11(50) \\ t_{50} = -24 + 550 \\ t_{50} = 526 \end{array} \quad \begin{array}{l} t_n = a + (n-1)d \\ t_{50} = a + 49d \\ 53 = a + 6d \\ 97 = a + 10d \\ 44 = 4d \\ \boxed{d = 11} \end{array} \quad \begin{array}{l} \text{sub } d \text{ into } ① \\ 53 = a + 6(11) \\ a = -13 \end{array}$$

5. Given the following series: $2 + 4 + 6 + \dots$ and that the sum of the terms is 110. Find the number of terms in the series. (5T marks)

$$\begin{array}{l} 2+4+6+\dots \\ \uparrow \uparrow \\ 2+2 \\ \hline S_n = 110 \end{array} \quad \begin{array}{l} S_n = \frac{n}{2} [2a + (n-1)d] \\ S_n = \frac{n}{2} [2(2) + (n-1)2] \\ S_n = n[4 + 2n - 2] \\ S_n = n[2 + n] \end{array} \quad \begin{array}{l} 220 = n(2 + n) \\ 0 = 2n^2 + 2n - 220 \\ 0 = n^2 + n - 110 \\ 0 = (n+11)(n-10) \\ n = 10 \end{array} \quad \begin{array}{l} \boxed{n_1 = -11} \quad \boxed{n_2 = 10} \\ \therefore n_1 \text{ is neg} \\ \therefore n = 10 \end{array}$$

6. a) Complete the next 3 lines of Pascal's Triangle. (3K marks)

$$\begin{array}{c} 1 \\ 1 \ 1 \\ 1 \ 2 \ 1 \\ 1 \ 3 \ 3 \ 1 \\ 1 \ 4 \ 6 \ 4 \ 1 \\ 1 \ 5 \ 10 \ 10 \ 5 \ 1 \end{array}$$

- b) Determine an expanded expression for: $(x^2+2)^4$. (4K marks)

$$\begin{aligned} (x^2+2)^4 &= (x^2)^4 + 4(x^2)^3(2) + 6(x^2)^2(2)^2 + 4(x^2)(2)^3 + (2)^4 \\ &= x^8 + 8x^6 + 24x^4 + 32x^2 + 16 \end{aligned}$$

Communication (3C marks) - form, units, formulas, etc. throughout the quiz.

BONUS: Put the following sequence into summation notation

$$1-1/3+1/5-1/7+\dots$$

$$\sum_{i=1}^{\infty} \left(\frac{1}{2i-1} \times (-1)^{i+1} \right)$$

$$\begin{aligned} I &= PRT \\ A &= P(1+i)^n \\ FV &= \frac{R}{i} [(1+i)^n - 1] \\ PV &= \frac{R}{i} [1 - (1+i)^{-n}] \end{aligned}$$

Financial Applications Test

1. Joey borrows \$1400 to buy a road racing bicycle. He repays the loan with an amount of \$2000. Given a rate of 5% simple interest, how long did it take him to pay the loan? (3K marks)

$$\begin{aligned} I &= PRT & J = A - P & \therefore 8.571 \text{ years} \\ 600 &= 1400(0.05)T & J = 2000 - 1400 & \text{loan} \\ T &= 8.571 & J = 600 & \text{loan} \end{aligned}$$

2. Jim's parents want to put some money in account so that in 10 years, Jim will have \$10000. The rate of the bank account was 6% per year compounded semi-annually. How much money should Jim's parents invest into the account? (3K marks)

$$\begin{aligned} A &= P(1+i)^n & \therefore \text{They should put in } \$5536.76 \\ 10000 &= P\left(1 + \frac{0.06}{2}\right)^{2(10)} & \\ P &= \$5536.76 \end{aligned}$$

3. Lucy wants to have \$20000 in her account in 4 years to buy a new car.

- a. How much must she invest per month if her account earns 3.6% annual interest, compounded monthly? (4K marks)

$$\begin{aligned} FV &= R \frac{(1+i)^n - 1}{i} & 20000 &= R \frac{\left(1 + \frac{0.036}{12}\right)^{48} - 1}{0.003} \rightarrow R = 388.01 \\ R &= \frac{FV}{\frac{(1+i)^n - 1}{i}} & 60 &= R \frac{(1.003)^{48} - 1}{0.003} \rightarrow \therefore \text{she should invest} \\ R &= \$388.01 \end{aligned}$$

- b. How much did Lucy make in interest? (1K mark)

$$\begin{aligned} I &= FV - Rn & I &= 20000 - (388.01)(12)(4) \\ I &= 1375.52 & \therefore & \$1375.52 \text{ in interest.} \end{aligned}$$

4. Manual invests \$1000 in a GIC that earns 4% interest per year, compounded monthly. How much interest is earned after 10 months? (3K marks)

$$\begin{aligned} A &= P(1+i)^n & J &= A - P \\ A &= 1000 \left(1 + \frac{0.04}{12}\right)^{10} & J &= 1033.84 - 1000 \\ A &= \$1033.84 & J &= 33.84 \end{aligned}$$

∴ \$33.84 was earned
in interest

5. Lauren plans to withdraw \$650 at the end of every 3 months, for 5 years, from an account that earns 6.4% interest, compounded quarterly. How much was there originally? (3K marks)

$$\begin{aligned} PV &= R \frac{1 - (1+i)^{-n}}{i} & PV &= 650 \frac{1 - (1 + \frac{0.064}{4})^{-4(5)}}{0.016} \\ PV &= 176.806 & PV &= \$11050.38 \\ PV &= 11050.38 & \therefore \text{There was } \$11050.38 \\ & & \text{in the account originally} \end{aligned}$$

6. Ken wants to receive \$200 every three months at 5.2%/a compounded quarterly. He currently has 6500 to invest. How long will he receive regular payments for? (5K marks)

$$\begin{aligned} PV &= R \frac{1 - (1+i)^{-n}}{i} & \log\left(\frac{115.5}{200}\right) &= \log\left(1 + \frac{0.052}{4}\right)^{-n} & n = \text{years} \times \text{compounding period} \\ 6500 &= 200 \frac{1 - (1 + \frac{0.052}{4})^{-n}}{0.013} & \log\left(\frac{115.5}{200}\right) &= -n \log\left(1 + \frac{0.052}{4}\right) & \text{years} = \frac{n}{\text{comp. p.}} \\ 84.5 &= 200 \left[1 - \left(1 + \frac{0.052}{4}\right)^{-n}\right] & -n &= \log\left(\frac{115.5}{200}\right) / \log\left(1.013\right) & \text{years} = 10.627 \\ \frac{84.5}{200} &= 1 - \left(1 + 0.052/4\right)^{-n} & n &= 42.5083 & \therefore \text{He will} \\ \frac{115.5}{200} &= \left(1 + 0.052/4\right)^{-n} & & & \text{receive them} \\ & & & & \text{for 10.627 years.} \end{aligned}$$

7. Paul borrows \$250 for 4 years at an interest rate that is compounded quarterly. At the end of the 4 years he repays \$500. What annual interest rate, compounded quarterly, was Paul charged? (4T marks)

$$A = P(1+i)^n$$
$$500 = 250(1+i)^{16}$$
$$2 = (1+i)^{16}$$
$$\sqrt[16]{2} = 1+i$$
$$i = \frac{\sqrt[16]{2} - 1}{\text{comp. period}}$$
$$i = 0.04427$$
$$\text{rate} = (i)(\text{comp. period})$$
$$\text{rate} = 0.04427(4)$$
$$\text{rate} = 0.177$$

He was charged 17.7% BONUS

8. Jill invests \$300 a month at a rate of 5%/a compounded monthly for 2 years. She then takes the money in that account and moves it in an account with a better rate for 5 more years at 6%/a compounded quarterly. How much does she have at the end of the 7 years? (5A marks)

Communication (5C marks) - marks are awarded for proper form, use of formulas, units, sentences, etc.