SYDNEY TECHNICAL HIGH SCHOOL

Year 9 Yearly

2014

Name : .....

Teacher:.....

Time Allowed: 70 minutes

INSTRUCTIONS TO STUDENTS

- Questions are not of equal value
- Approved calculators may be used
- All necessary working should be shown
- Write using black or blue pen
- Full marks may not be awarded for careless work or illegible writing

EXAMINER'S USE ONLY

Question	Total	Mark
Factorisation	10	
Q 1,2,3	6	
Coordinate Geometry	11	
Q 4	5	
Equations Inequations & Formula	8	
Q5,6,7,8	8	
Statistics	10	
Q9	3	
Trigonometry	8	
Q 10	6	
Total	75	

Factorisation **10 Marks**

Factorise fully the following:

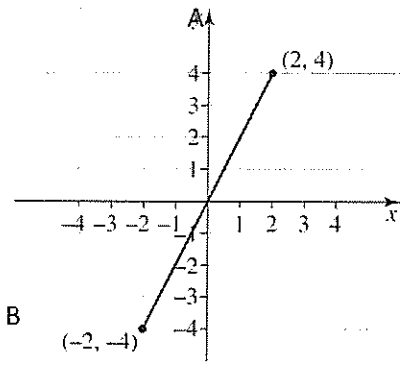
1	$60x^2 - 45xy$ (1)	2	$9a^2 - 100b^2$ (1)
3	$2y^2 + 3y - 2$ (1)	4	$x^2 - 4x - 5$ (1)

Simplify where possible:

5	$\dfrac{p^2 + p - 12}{2p + 8}$ (2)	6	$\dfrac{t-5}{4(t+2)} \div \dfrac{t}{t+2}$ (1)
7	$\dfrac{3x-2}{27} - \dfrac{4x+3}{9}$ (2)	8	$\dfrac{m-2}{2-m}$ given that $m \neq 2$ (1)

Co-ordinate Geometry

11 Marks

1	Calculate the gradient of AB:  (1)	2	A straight line passes through the points (2, 1) and (5, 4). Calculate its gradient. (1)
3	The x-intercept of the linear graph $y = 5x - 6$ is: (1)	4	The equation of a linear graph with gradient 5 that passes through the point (6, –4) is: **(Write your answer in the form $y = mx + b$** (2)
5	The gradient of the line perpendicular to $2x - 5y - 7 = 0$ is: (2)		
6	Calculate the distance between (4, –3) and (–1, –5) . **Leave your answer in surd form.** (1)	7	Calculate the midpoint of the line segment between the point (–4, 8) and (2, –6): (1)
8	Find the equation of the line parallel to the x axis but 3 units below it. (1)	9	Write down the equation of the line with a gradient of 3 and a y intercept of -4 (1)

Equations, Inequations and Formula

8 marks

Solve the following:

1	$4x + 3 = 7x + 33$ (1)	2	$\frac{5}{x-2} = \frac{-7}{8}$. (1)
3	$x - 5 > 2x$ (1)	4	$6 - 3(x + 4) > 19$ (2)
5	Rearrange the following equation to make x the subject $y = ax + b$ (1)	6	$4(n + 3) = 2(7 - 4n) + 5$ (2)

Statistics

10 marks

1 From the following stem and leaf graph state the number of pieces of data, the range and the class size.

Key: 3 | 2 = 32

Stem | *Leaf*

2 | 1 4 6 9
3 | 0 0 3 5 9 9 9
4 | 2 4 7 8
5 | 0 0 1 3 4

Range:

Class size: (2)

2 The number of goals scored in each match by a soccer team is shown below.

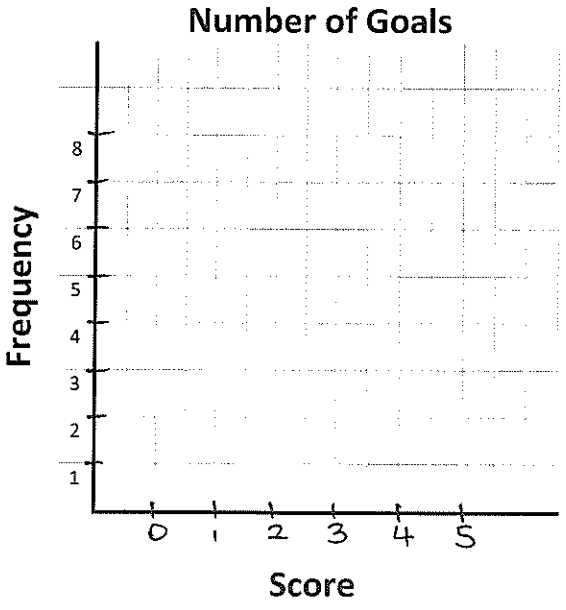
0 2 3 4 2 1 5 2 3 3
1 2 4 1 0 0 2 1 0 2
2 1 0 1 3

(a) Display the results in a frequency table.

Score	Tally	Frequency
0		
1		
2		
3		
4		
5		

(1)

(b) Display the data as a combined histogram and frequency polygon.



(2)

3 The table below shows the number of days that students were absent in a class over one term.

Score	Frequency	Cumulative frequency
0	2	
1	5	
2	9	
3	5	
4	4	
5	3	
6	2	

(a) Complete the cumulative frequency column. (1)

(b) Find the number of students who were absent for fewer than 4 days during the term. (1)

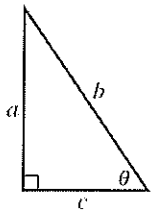
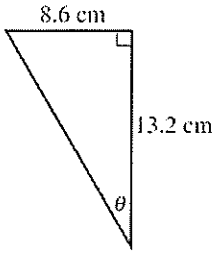
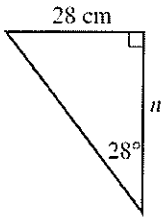
(c) Find the median (1)

(d) Find the mean (1)

(e) Find the mode (1)

Trigonometry

8 Marks

1.	Write an expression for $\cos\theta$  (1)	2.	Calculate the value of θ accurate to the nearest degree.  (2)
3.	What is sin 58° rounded to 4 decimal places? (1)	4.	If $\cos\theta = 0.0349$, find the value of θ to the nearest degree. (1)
5.	Find the value of n correct to 2 decimal places.  (2)	6.	What is S20°W as a true bearing? (1)

Miscellaneous

1. Factorise and simplify where possible:

   a. $(y+1)^2-(x+6)^2$

(2)

2. Simplify :

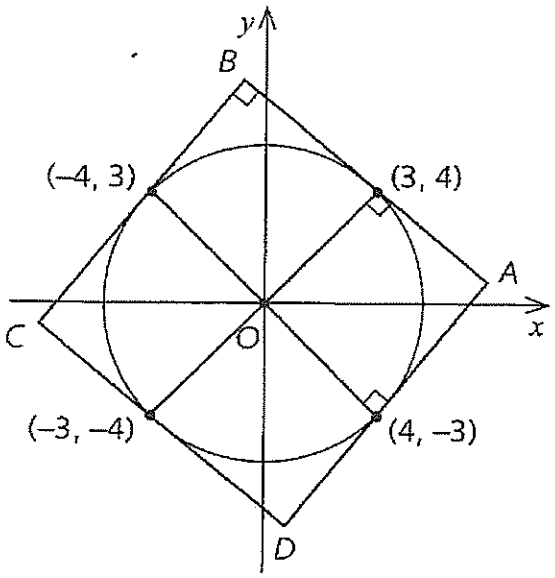
$$\frac{4}{(x+1)(x-2)}+\frac{5}{(x-2)(x+4)}$$

(2)

3. Paul manufactures frames for reading glasses. He finds that his profit $\$P$ per day is given by the formula $p = 70x - 5x^2$ where x is the number of frames made per day. When does Paul make a profit of $240 per day?

(2)

4. A circle is enclosed within a square:



a. Find the equation of the line AB (3)

b. Find the distance AB (2)

5. Solve for *x*:

$$\frac{2x+1}{3} - \frac{1-x}{6} = 2\frac{1}{2}$$

(2)

6. Mary Jane wishes to hire a car for 1 day. She has a total of $65 to spend. The Acapulco Gold Car Rental company charges a flat fee of $30 per day plus $0.23 per kilometre. How far can she travel on her budget?

(2)

7. The Columbian Car Rental Company charges a flat fee of $38 per day, but only $0.19 per kilometre. Comparing this rate with the Acapulco Gold company from the previous question, for what distance will the total cost from the two companies be the same?

(2)

8. A man is currently three times as old as his son. Four years ago he was four times as old as his son was then. How old is his son now?

(2)

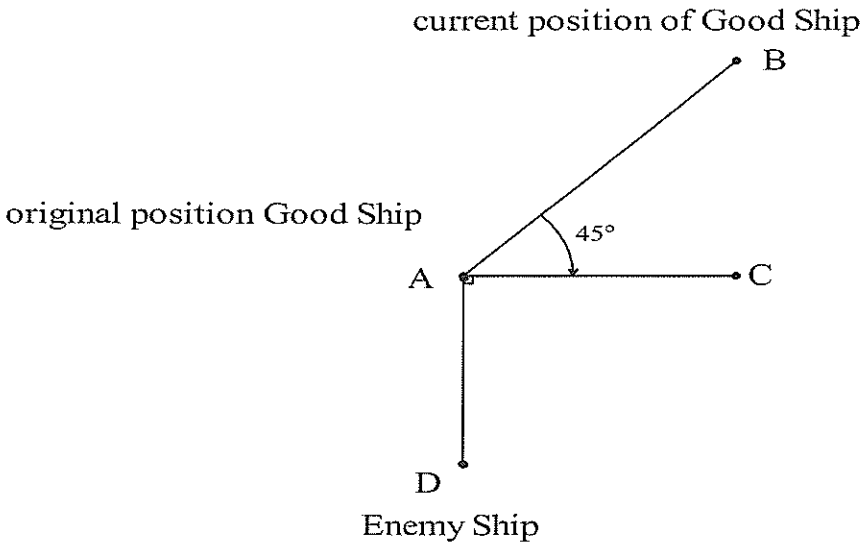
9. In an office there are 19 people and only four levels of salary paid:
$40 000 (1 person), $32 000 (3 people), $25 000 (6 people) and $18 000 (9 people).

a. Find the median and modal salaries of this group (2)

b. Explain why the mode is an unsatisfactory measure of the middle in this case. (1)

Continued on next page

10. The 'Good Ship' is at A, 1km due north of the 'Enemy Ship' at 12pm. After this time the good ship moves on a bearing of 045^0T (position B), while the enemy ship remains stationary, at D, as shown below:



a. The good ship has travelled 1.5km from A. Find, to the nearest metre:

i. How far East it is from its original position at A? (2)

ii. How far North it is from its original position at A? (2)

iii. How far it is from the enemy ship (2)

Factorisation

11 Marks

Factorise fully the following:

1. $60x^2 - 45xy$

$15x(4x - 3y)$ (1)

2. $9a^2 - 100b^2$

$(3a)^2 - (10b)^2$

$= (3a - 10b)(3a + 10b)$ (1)

3. $2y^2 + 3y - 2$

$(2y - 1)(y + 2)$ (1)

4. $x^2 - 4x - 5$

$(x - 5)(x + 1)$ (1)

Simplify where possible:

5. $\frac{p^2 + p - 12}{2p + 8}$

$= \frac{(p + 4)(p - 3)}{2(p + 4)}$

$= \frac{p - 3}{2}$ (2)

6. $\frac{t - 5}{4(t + 2)} \div \frac{t}{t + 2}$

$= \frac{t - 5}{4(t + 2)} \times \frac{t + 2}{t}$

$= \frac{t - 5}{4t}$ (1)

7. $\frac{3x - 2}{27} - \frac{4x + 3}{9}$

$\frac{3x - 2}{27} - \frac{(12x + 9)}{27}$

$= \frac{-9x - 11}{27}$ (2)

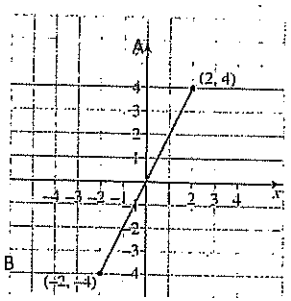
8. $\frac{m - 2}{2 - m}$ given that $m \neq 2$

$= -1$ (2)

Co-ordinate Geometry

11 Marks

1. Calculate the gradient of AB:



$\frac{\text{rise}}{\text{run}} = \frac{8}{4}$

$= 2.$ (1)

2. A straight line passes through the points (2, 1) and (5, 4). Calculate its gradient.

$m = \frac{1 - 4}{2 - 5}$

$= \frac{-3}{-3}$

$= 1$ (1)

3. The x-intercept of the linear graph $y = 5x - 6$ is:

$y = 0 \quad 5x - 6 = 0$

$5x = 6$

$x = 6/5$ (1)

4. The equation of a linear graph with gradient 5 that passes through the point (6, –4) is:
(Write your answer in the form $y = mx + b$

$y + 4 = 5(x - 6)$

$y + 4 = 5x - 30$

$y = 5x - 34$ (2)

5. The gradient of the line perpendicular to $2x - 5y - 7 = 0$ is:

$-5y = -2x + 7$

$y = 2/5x + 7/5$

$m = -5/2$ (2)

6. Calculate the distance between (4, –3) and (–1, –5) . **Leave your answer in surd form.**

$d = \sqrt{(-3 + 5)^2 + (4 + 1)^2}$

$= \sqrt{4 + 25}$

$= \sqrt{29}$ (1)

7. Calculate the midpoint of the line segment between the point (–4, 8) and (2, –6):

$MP = \left(\frac{-4 + 2}{2}, \frac{8 - 6}{2}\right)$

$= (-1, 1)$ (1)

8. Find the equation of the line parallel to the x axis but 3 units below it.

$y = -3$ (1)

9. Write down the equation of the line with a gradient of 3 and a y intercept of -4

$y = 3x - 4$ (1)

Equations, Inequations and Formula

8 marks

Solve the following:

1 $4x + 3 = 7x + 33$

$-30 = 3x$

$x = -10$

(1)

2 $\frac{5}{x-2} = \frac{-7}{8}$.

$-7x + 14 = 40$

$-7x = +26$

$x = -26/7$

(1)

3 $x - 5 > 2x$

$-5 > x$

$x < -5$

(1)

4 $6 - 3(x + 4) > 19$

$6 - 3x - 12 > 19$

$-3x > 25$

$3x < -25$

$x < -25/3$

(2)

5 Rearrange the following equation to make x the subject

$y = ax + b$

$\frac{y-b}{a} = \frac{ax}{a}$

$x = \frac{y-b}{a}$.

(1)

6 $4(n + 3) = 2(7 - 4n) + 5$

$4n + 12 = 14 - 8n + 5$

$12n = 7$

$n = 7/12$

(2)

Statistics

10 marks

1 From the following stem and leaf graph state the number of pieces of data, the range and the class size.

Key: 3 | 2 = 32

Stem	*Leaf*
2	1 4 6 9
3	0 0 3 5 9 9 9
4	2 4 7 8
5	0 0 1 3 4

Range: $54 - 21 = 33$

Class size: 10

(2)

2 The number of goals scored in each match by a soccer team is shown below.

~~0 2 3 4 2 1 5 2 3 3~~

~~1 2 4 1 0 0 2 1 0 2~~

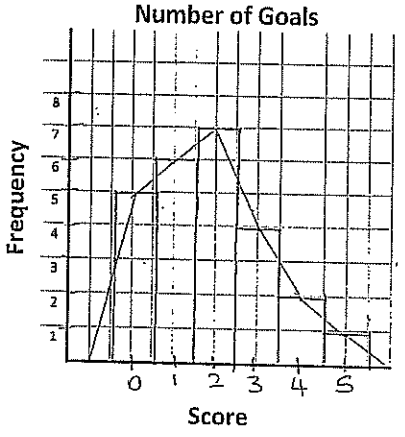
~~2 1 0 1 3~~

(a) Display the results in a frequency table.

Score	Tally	Frequency
0	𝍸	5
1	𝍸 |	6
2	𝍸 ||	7
3	|||	4
4	||	2
5	|	1

(1)

(b) Display the data as a combined histogram and frequency polygon.



(2)

3 The table below shows the number of days that students were absent in a class over one term.

Score	Frequency	Cumulative frequency
0	2	2
1	5	7
2	9	16
3	5	21
4	4	25
5	3	28
6	2	30

(a) Complete the cumulative frequency column. (1)

(b) Find the number of students who were absent for fewer than 4 days during the term.

21 (1)

(c) Find the median

2 (1)

(d) Find the mean

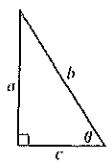
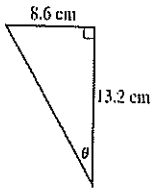
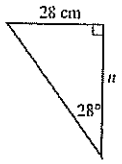
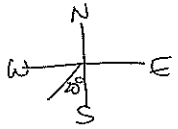
2.7 (1)

(e) Find the mode

2. (1)

Trigonometry

8 Marks

1.	Write an expression for $\cos\theta$  $\cos\theta = \frac{c}{b}$ (1)	2.	Calculate the value of θ accurate to the nearest degree.  $\tan\theta = \frac{opp}{adj}$ $= \frac{8.6}{13.2}$ $\theta = 33^\circ$ (2)
3.	What is sin 58° rounded to 4 decimal places? 0.8480 (1)	4.	If $\cos\theta = 0.0349$, find the value of θ to the nearest degree. 88° (1)
5.	Find the value of n correct to 2 decimal places.  $\tan 28 = \frac{28}{n}$ $n = \frac{28}{\tan 28}$ $= 52.66$ (2)	6.	What is S20°W as a true bearing?  200T (1)

Miscellaneous

1. Factorise and simplify where possible:
   a. $(y+1)^2-(x+6)^2$

$= (y+1+x+6)(y+1-x-6)$

$= (x+y+7)(y-x-5)$

(2)

2. Simplify:

$$\frac{4}{(x+1)(x-2)} + \frac{5}{(x-2)(x+4)}$$

$$= \frac{4(x+4)+5(x+1)}{(x+1)(x-2)(x+4)}$$

$$= \frac{4x+16+5x+5}{(x+1)(x-2)(x+4)}$$

$$= \frac{9x+21}{(x+1)(x-2)(x+4)}$$

(2)

3. Paul manufactures frames for reading glasses. He finds that his profit $\$P$ per day is given by the formula $p = 70x - 5x^2$ where x is the number of frames made per day. When does Paul make a profit of $240 per day?

$70x - 5x^2 = 240$

$-5x^2 + 70x - 240 = 0$

$5x^2 - 70x + 240 = 0$

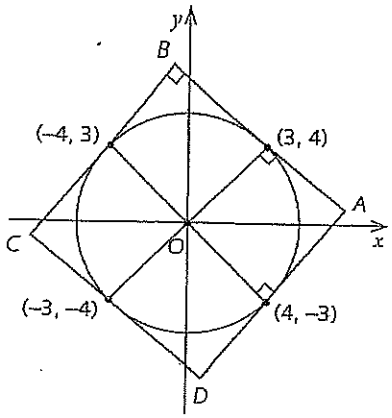
$5(x^2 - 14x + 48) = 0$

$(x-6)(x-8) = 0$

either 6 or 8 frames per day

(2)

4. A circle is enclosed within a square:



a. Find the equation of the line AB (3)

find ~~eqn~~ grad of $(-4,3)$ & $(4,-3)$

$$m = \frac{-3-3}{4+4} = \frac{-6}{8} = -\frac{3}{4}$$

Eqn $m = -3/4$ $(3,4)$

$$y - 4 = -\frac{3}{4}(x-3)$$

$$y = -\frac{3}{4}x + \frac{9}{4} + 4.$$

$$y = -\frac{3}{4}x + \frac{25}{4}.$$

b. Find the distance AB (2)

$$d = \sqrt{(-4,-4)^2 + (3+-3)^2}$$

$$= \sqrt{64 + 81}$$

$$= \sqrt{145}$$

5. Solve for x:

$$\frac{2x+1}{3} - \frac{1-x}{6} = 2\frac{1}{2}$$

$$\frac{2x+1}{3} - \frac{1-x}{6} = \frac{5}{2}.$$

$$2(2x+1) - (1-x) = 15$$

$$4x + 2 - 1 + x = 15$$

$$5x = 14$$

$$x = 14/5$$

(2)

6. Mary Jane wishes to hire a car for 1 day. She has a total of \$65 to spend. The Acapulco Gold Car Rental company charges a flat fee of \$30 per day plus \$0.23 per kilometre. How far can she travel on her budget?

$$\text{Cost} = \$30 + 0.23x$$

$$\$65 = 30 + 0.23x.$$

$$35 = 0.23x$$

$$x = 152.17 \text{ km}.$$

(2)

7. The Columbian Car Rental Company charges a flat fee of \$38 per day, but only \$0.19 per kilometre. Comparing this rate with the Acapulco Gold company from the previous question, for what distance will the total cost from the two companies be the same?

$$\text{Cost} = \$38 + 0.19x.$$

$$38 + 0.19x = 30 + 0.23x.$$

$$8 = 0.04x.$$

$$x = 200 \text{ kms}.$$

(2)

8. A man is currently three times as old as his son. Four years ago he was four times as old as his son was then. How old is his son now?

let son $= x$.

$$3x - 4 = 4(x-4)$$

$$3x - 4 = 4x - 16$$

$$12 = x.$$

∴ son is currently 12 years.

(2)

9. In an office there are 19 people and only four levels of salary paid:
$40 000 (1 person), $32 000 (3 people), $25 000 (6 people) and $18 000 (9 people).

a. Find the median and modal salaries of this group (2)

median = $25,000

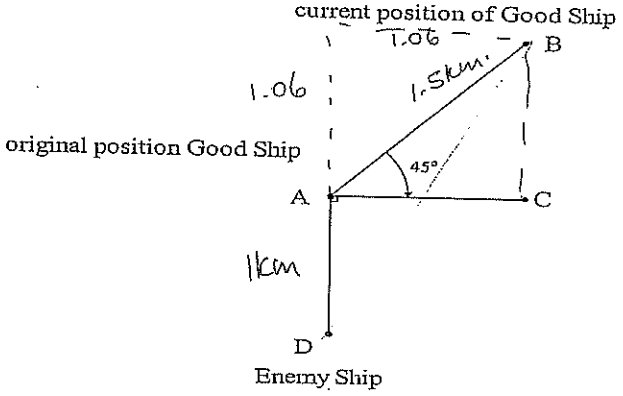
mode = $18,000

b. Explain why the mode is an unsatisfactory measure of the middle in this case. (1)

19 people in the office and of these 10 people earn more than the mode. but the mode is the lowest measure. The median is a closer measure of the middle. The scores may lean to one end but the end is not, in such cases, said to be the middle.

Continued on next page

10. The 'Good Ship' is a 1km due north of the 'Enemy Ship' at 12pm. After this time the good ship moves on a bearing of 045°T (position B), while the enemy ship remains stationary, at D, as shown below:



a. The good ship has travelled 1.5km from A. Find, to the nearest metre:

i. How far East it is from its original position at A? (2)

ii. How far North it is from its original position at A? (2)

iii. How far it is from the enemy ship (2)

(i) $\sin 45 = \frac{AC}{1.5}$ or $\frac{1}{\sqrt{2}} = \frac{BC}{1.5}$

$AC = 1.06\ldots$ $BC = \frac{3}{2\sqrt{2}}$

(ii) $\cos 45 = \frac{BC}{1.5}$ $AC = \frac{3}{2\sqrt{2}}$

$BC = 1.06$

(iii) $DB^2 = 1.06^2 + 2.06^2$

$DB = 2.316\ldots$