Name:
Maths Class:

YEARLY EXAMINATION
YEAR 10 2016
MATHEMATICS

Time Allowed – 120 minutes
(Plus 5 minutes Reading time)

Question	Q 11	Q12	Q13	Q14	Q15	MC	Total
Algebra	a /2	b,c,d,e,g,h /14	a,b,c,d,f /14	c /6	c /4		/40
Coord Geom & Graphing	b, c /6	f /4	e /4				/14
Geometry			g /2	d /7	f /3		/12
Probability		a /2			a, b /6		/8
Statistics	d, e /9						/9
Trigonometry	f /3			a, b /7	d, e /7		/17
Other						/10	/10
Total	/20	/20	/20	/20	/20	/10	/110

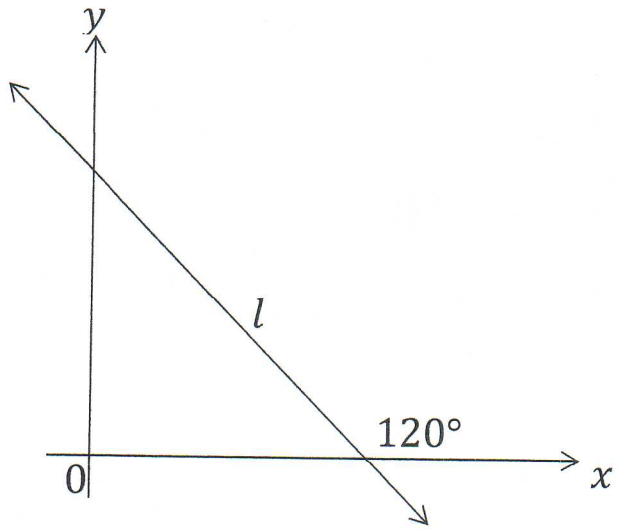
INSTRUCTIONS:

- All questions may be attempted.
- Write your **name** and **Maths class** at the top of each page.
- **Write** in **Pen** and draw diagrams in **Pencil.**
- Answers to Multiple choice Questions 1-10 are to be entered onto the answer sheet provided.
- Answers to Questions 11-15 are to be returned in separate bundles.
- Department of Education approved calculators and templates are permitted.
- Show all necessary working.
- Marks may not be awarded for untidy or carelessly arranged work.
- No grid paper is to be used unless provided with the examination paper.

Section I: Questions 1-10 (1 mark each)

Answer on separate multiple choice sheet

1.



The diagram above, shows the line *l*.

What is the slope of the line *l*?

a) $\sqrt{3}$ b) $-\sqrt{3}$ c) $\frac{1}{\sqrt{3}}$ d) $-\frac{1}{\sqrt{3}}$

2. What is the probability that the sum of two die will be greater than 8, given that the first die is 6?

a) $\frac{5}{18}$ b) $\frac{3}{4}$ c) $\frac{2}{3}$ d) $\frac{7}{11}$

3. 4 people can paint a fence in 3 hours, assuming that they all work at the same rate. How long will it take 6 people to paint the same fence?

a) 8 hours b) 2 hours c) 1.5 hours d) 1 hour

4. Solve for $(x-3)(2x+1)(2-x)^2 \leq 0$

a) $x \leq -\frac{1}{2}, x \geq 3$ b) $-\frac{1}{2} \leq x \leq 3$

c) $x \leq -\frac{1}{2}, x \geq 3, x = 2$ d) $-\frac{1}{2} \leq x \leq 3, x \neq 2$

5. For $x^2 + 2x + 5$ to be a factor of $x^4 + px^2 + q$, the values of p and q must be:

a) $-2, 5$ b) $5, 25$ c) $10, 20$ d) $6, 25$

6. The equation $x + \sqrt{x-2} = 4$ has:

a) 2 real roots b) 1 real and 1 imaginary root

c) no roots d)1 real root

7. The least value of the function $ax^2 + bx + c$ $(a > 0)$ is:

a) c b) $-\frac{b}{2a}$ c) $b^2 - 4ac$ d) $\frac{4ac-b^2}{4a}$

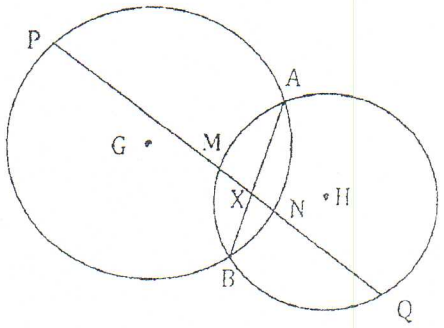
8. $\log p + \log q = \log(p + q)$ only if:

a) $p = \frac{q^2}{1-q}$ b) $p = q = 1$ c) $p = \frac{q}{q-1}$ d) $p = \frac{q}{q+1}$

9. If $x = 3 + 2\sqrt{2}$, then the value of $\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)$ equals?

a) 0 b) 2 c) 3 d) $4\sqrt{2}$

10. AB is a common chord to the circles with centres G and H. PQ is drawn intersecting circle centre G at P and N, intersecting circle with centre H at M and Q, and intersecting AB at X as shown in the diagram. If $PM = 18, MX = 6$ and $NQ = 15$, then the length of NX is:



a) 5 b) 4 c) 3 d) 2

Section II: Questions 11-15 (20 mark each)

Question 11

Marks

a) If $\log_a 3 = 0.477$ and $\log_a 4 = 0.602$, find the value of $\log_a(0.75a^2)$ **2**

b) The point $(-11, 20)$ divides the points $A(-3,5)$ and $B(5,-10)$ externally in the ratio $m:n$. Determine the ratio $m:n$. **2**

c) i) Determine the centre and radius of the circle $x^2 + y^2 - 4x + 2y - 20 = 0$ **2**

ii) Does the line $3x - 4y + 12 = 0$ touch the circle at 0, 1 or 2 points? Justify your answer. **2**

d) The following data set shows the data trend of the average height of infants from 12 to 48 months.

Age (months)	12	18	24	30	36	42	48
Height (cm)	78	83	88	93	98	103	108

i) Graph the above information as a scatter graph. **2**

ii) Comment on the relationship of the data set. **1**

iii) Determine the equation of the line of best fit. **2**

iv) Is it possible to extrapolate data from this line of best fit? Why or why not? **2**

e) A given data set has a mean of x and a standard deviation of s. What will the new mean and standard deviation be if a constant k is added to each data value in the given set? **2**

f) Solve for $0° < x < 360°$, $5\sec^2 x + 7\tan x = 3$, to the nearest degree. **3**

Question 12 START A NEW PAGE

a) The probability that Joe gets a concert booking with his band on any given weekend is 0.65. What is the probability that over two consecutive weekends, he will get at least one concert booking? **2**

b) Solve for x, where $x \in R$

$(x^2 - 4x)^2 + 11(x^2 - 4x) + 28 = 0$ **3**

c) Find the sum of $\frac{1}{\sqrt{1}+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \cdots + \frac{1}{\sqrt{99}+\sqrt{100}}$. **2**

d) Solve for x: $\left(25\sqrt{5}\right)^x = \left(\sqrt[3]{5}\right)^{x+1}$ **2**

e) Simplify: $\frac{2^{n+4}-2(2^n)}{2(2^{n+3})}$ **2**

f) For the function: $y = -\sqrt{4 - x^2}$

i) State the domain and range **2**

ii) Does this function have an inverse function? If not, what restrictions will enable this function to have an inverse? **2**

g) Find the values of k for which $2x^2 - kx + 3 = 0$ have real and unequal roots. **2**

h) Find a, b and c if $2x^2 + 4x + 5 \equiv a(x-3)^2 + b(x-3) + c$ **3**

Question 13 START A NEW PAGE

a) The average number of phone calls per day (N) between two cities varies directly as the product of the population (P_1 *and* P_2) of the cities and inversely as the square of the distance (d) between the two cities. The population of Troy is about 1 500 000 and the population of Smallville is 1 200 000. The distance between the two cities is $400km$ and the average number of calls is 200 000. Find the distance between Troy and Metropolis, which has a population of 1 700 000, if the average number of calls is 134 000. Answer to the nearest km. **3**

b) Given that y varies directly as x^3 and inversely as r^2. What is the effect on y if x is doubled and r is halved? **2**

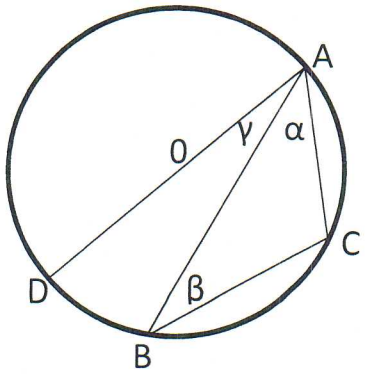
c) Solve the simultaneous equation: $2^x = 11 - 3^y$ and $2^{x-2} + 3^{y+2} = \frac{163}{2}$ **3**

d) Prove the following: $\log_{b^4} x^2 = \log_b \sqrt{x}$ **3**

e) Graph $y = \frac{x-1}{x^2+1}$ showing all asymptotes and intercepts. **4**

f) The polynomial $P(x)$ is divided by $(x + 4)(x - 3)$. Find the remainder, given that $P(-4) = 11$ and $P(3) = -3$ **3**

g) In the diagram below, A, B, C and D lie on the circle with centre O and diameter AD. Given that $\angle BAC = \alpha, \angle ABC = \beta$ and $\angle DAB = \gamma$, find the value of $\alpha + \beta + \gamma$, giving reasons. Copy or trace the diagram on your paper. **2**



Question 14 START A NEW PAGE

a) Prove: $\frac{cos\theta}{1-tan\theta} + \frac{sin\theta}{1-cot\theta} = sin\theta + cos\theta$ **3**

b) Graph $y = 2 - 2\cos(4x)$ in the domain $0° \leq x < 180°$ **4**

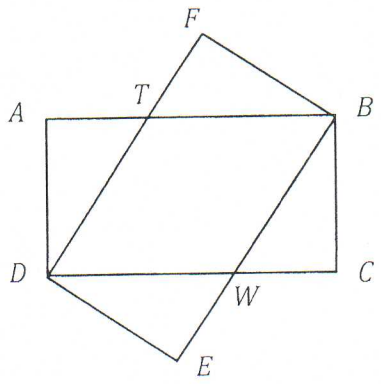
c) Let $P(x) = -x^4 + 5x^3 + 4x^2 - 44x + 48$

i) Show that (x-2) and (x-4) are factors of P(x) **2**

ii) Hence or otherwise factorise P(x) into its 4 linear factors **2**

iii) Hence or otherwise, graph $P(x)$ showing all essential features. **2**

d) $ABCD$ and $DEBF$ are two congruent rectangles with sides 3 and 7 units as in the diagram. $(AB = DF = 7, AD = DE = 3)$. Copy or trace the diagram onto your paper.



i) Show that $AT = \frac{20}{7}$ **5**

ii) Find the area of the figure $DWBT$ **2**

Question 15 START A NEW PAGE

a) In a lottery, the probability of the jackpot being won in any draw is $\frac{1}{60}$.

i) What is the probability that the jackpot prize will be won in each of four consecutive draws? **1**

ii) How many consecutive draws need to be made for there to be a greater than 98% chance that at least one jackpot prize will have been won? **2**

b) 43 people were surveyed and asked whether they drank Coke, Sprite or Fanta. Three people drank all of these, while four people did not drink any of them. 19 drank Coke, 21 drank Sprite and 17 drank Fanta. One person drank Coke and Fanta but not Sprite.

i) Draw a Venn diagram representing this information. **2**

ii) Find the probability that a person selected at random from the group drank Sprite only. **1**

c) If α, β and γ are the roots of the equation $2x^3 + 3x^2 - 12 = 0$. Find the value of:

i) $\frac{1}{\propto} + \frac{1}{\beta} + \frac{1}{\gamma}$ **2**

ii) $\alpha^2 + \beta^2 + \gamma^2$ **2**

d) An aircraft which is maintaining a constant altitude of 1000 metres is travelling directly away from an observer. At a particular instant the angle of elevation is 52° and 12 seconds later the angle of elevation is 16°.

(i) Draw a diagram clearly illustrating all the above information. **1**

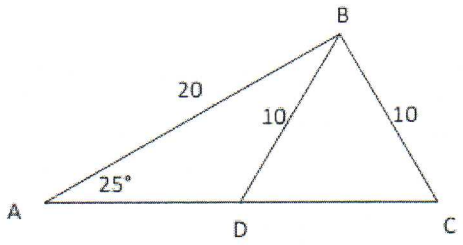
(ii) Find the distance the aircraft has travelled in this time. **2**

Question 15 (Continued)

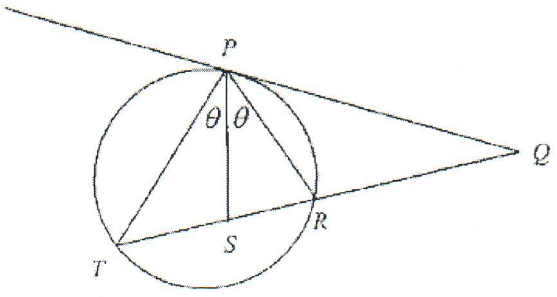
e) For the figure below

i) Find the size of $\angle ADB$ to the nearest minute. **2**

ii) Hence find the length DC **2**



f) In the diagram below, the vertices of the triangle PTR lie on a circle. The tangent at P meets the secant TR produced at Q. The bisector of $\angle TPR$ meets TR at S. Prove that $PQ = SQ$, giving reasons. **Copy** or trace the diagram onto your paper. **3**



END OF PAPER

YEAR 10 YEARLY

2016 EXAMINATION

M/Choice ANSWER SHEET

Name:

Maths Class:

10 QUESTIONS (1 MARK EACH)

Mark the appropriate answer with a cross **X**

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

HAND IN SEPARATELY AT THE END OF EXAM

11. a) $\log_a(0.75a^2)$

$= \log_a 0.75 + 2\log_a a$

$= \log_a 3 - \log_a 4 + 2$

$= 0.477 - 0.602 + 2$

$= 1.875$

(1) For separating all components correctly using Log laws

(2) Answer

b) $(-3, 5)$ $(5, 10)$

$m : -n$

$\therefore m : n = 1 : 2$

$\frac{-3(-n) + 5m}{m - n} = -11$ ——

$\therefore 3n + 5m = 11n - 11m$

$16m = 8n$

$\frac{m}{n} = \frac{1}{2}$ —— (1)

c) i. $(x^2 - 4x + 4) + (y^2 + 2y + 1) = 25$

$\therefore (x-2)^2 + (y+1)^2 = 25$ —— (1)

$\therefore$ centre is $(2, -1)$ and radius is 5 —

ii. Perpendicular distance $= \frac{|3(2) - 4(-1) + 12|}{5} = \frac{22}{5} = 4\frac{2}{5} <$

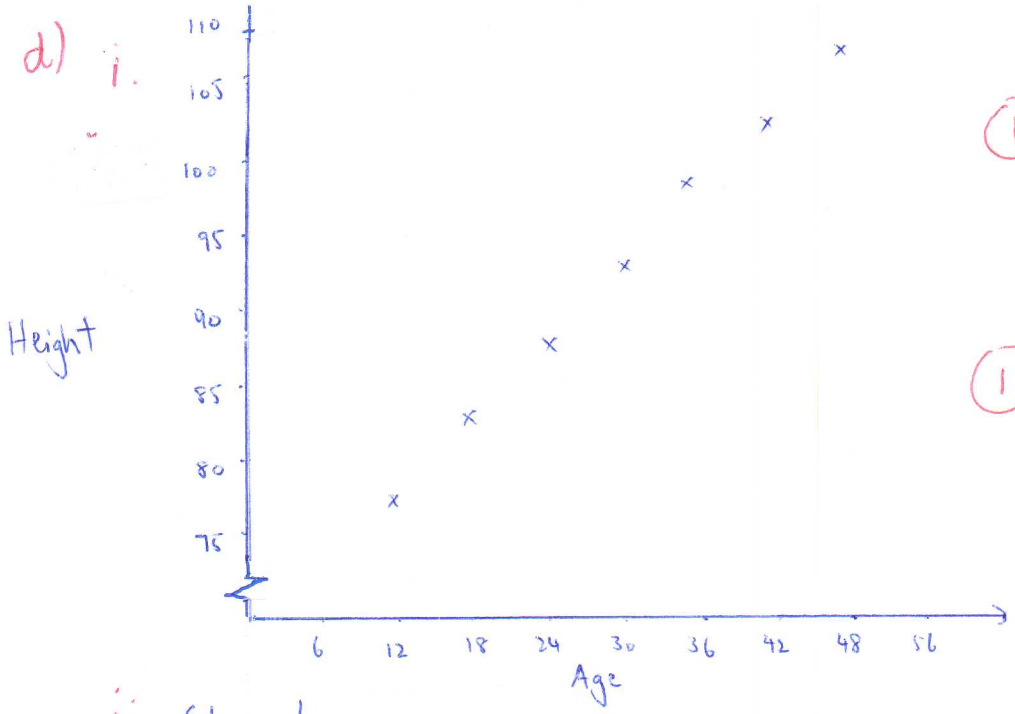
(1)

$\therefore$ Touches the circle at 2 points —— (1)

Or

Solve simultaneously and show that the resultant equation only has 1 solution or $\Delta = 0$

d) i.



(1) Knowing what a scatter plot is

(1) All points in the right place (lenient)

ii) Strong linear positive relationship ——— (1)

iii) $y = \frac{5}{6}x + 68$ or $5x - 6y + 408 = 0$

(1) gradient

(1) equation

iv) No, because age and height will not continue to be a linear relationship

(1) "No" with some explanation

(2) "No" with clear and correct explanation

e) mean: $5+k$ ——— (1)

Standard deviation: 5 ——— (1)

f) $5\sec^2 x + 7\tan x = 3$

$5(1 + \tan^2 x) + 7\tan x = 3$ ——— (1)

$5\tan^2 x + 7\tan x + 2 = 0$

$(5\tan x + 2)(\tan x + 1) = 0$

$\tan x = \frac{-2}{5}$ or -1 ——— (1)

$\therefore x = 338°, 158°, 315°$ or $135°$. ——— (1)

Question 12

a) P(at least one booking) = 1 - P(none) (1)

$= 1 - (0.35)(0.35)$

$= 0.8775$ (1)

b) $(x^2 - 4x)^2 + 11(x^2 - 4x) + 28 = 0$

$(x^2 - 4x + 7)(x^2 - 4x + 4) = 0$ (1)

$\therefore x^2 - 4x + 7 = 0$ or $x^2 - 4x + 4 = 0$

$x = \frac{4 \pm \sqrt{16 - 4(7)}}{2}$ $(x-2)^2 = 0$

$= \frac{4 \pm \sqrt{-12}}{2}$ $\therefore x = 2$ (1)

$= \frac{4 \pm 2\sqrt{3}i}{2}$ Not real roots

$= 2 \pm \sqrt{3}i$ (1)

c) $\frac{1}{\sqrt{1}+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \ldots + \frac{1}{\sqrt{99}+\sqrt{100}}$

$= \frac{\sqrt{1}-\sqrt{2}}{-1} + \frac{\sqrt{2}-\sqrt{3}}{-1} + \ldots + \frac{\sqrt{99}-\sqrt{100}}{-1}$ (1)

$= -\sqrt{1} + \sqrt{2} - \sqrt{2} + \sqrt{3} + \ldots - \sqrt{99} + \sqrt{100}$

$= -\sqrt{1} + \sqrt{100}$

$= -1 + 10$

$= 9$ (1)

d) $(25\sqrt{5})^x = (3\sqrt{5})^{x+1}$

$(5^2 5^{\frac{1}{2}})^x = (5^{\frac{1}{3}})^{x+1}$

$(5^{2\frac{1}{2}})^x = 5^{\frac{1}{3}(x+1)}$ (1)

$\therefore 2\frac{1}{2}x = \frac{1}{3}(x+1)$

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

$\frac{13}{6}x = \frac{1}{3}$

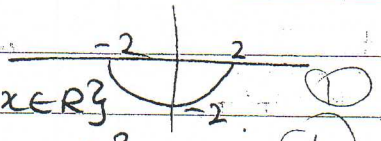
$\therefore x = \frac{2}{13}$ (1)

e) $\frac{2^{n+4} - 2(2^n)}{2(2^{n+3})} = \frac{2^n 2^4 - 2(2^n)}{2(2^n 2^3)}$ (1)

$= \frac{2^n(2^4 - 2)}{2^n(2 \times 2^3)}$

$= \frac{7}{8}$ (1)

f) i) $y = -\sqrt{4 - x^2}$



domain: $\{x: -2 \leq x \leq 2, x \in R\}$ (1)

range: $\{y: -2 \leq y \leq 0, x \in R\}$ (1)

ii) no, does not satisfy the horizontal line test, (1)

restriction: either $-2 \leq x \leq 0$ or $0 \leq x \leq 2$. (1)

g) for real & unequal roots

$\Delta > 0$ (1)

$k^2 - 4(2)(3) > 0$

$k^2 - 24 > 0$



$(k - \sqrt{24})(k + \sqrt{24}) > 0$

$\therefore x < -2\sqrt{6}, \quad x > 2\sqrt{6}$ (1)

h) $2x^2 + 4x + 5 \equiv a(x-3)^2 + b(x-3) + c$

$= a(x^2 - 6x + 9) + b.x - 3b + c$

$= ax^2 - 6ax + 9a + bx - 3b + c$

$= ax^2 + x(b - 6a) + 9a - 3b + c$

equating coefficients:

$a = 2$, -(1)

$b - 6a = 4$ -(2)

$9a - 3b + c = 5$ -(3)

sub. (1) into (2)

$b - 2(6) = 4$

$b = 16$ -(4)

sub. (1) & (4) into (3).

$9(2) - 3(16) + c = 5$

$\therefore c = 35$

$\therefore a = 2, b = 16, c = 35$

Question 13

a) $N \propto \frac{P_1 P_2}{d^2}$

$\therefore N = \frac{k P_1 P_2}{d^2}$ (1)

$200000 = \frac{k \times 1500000 \times 1200000}{(400)^2}$

$k = \frac{4}{225}$ (1)

$\therefore 134000 = \frac{1500000 \times 1700000 \times \frac{4}{225}}{d^2}$

$d^2 = 338308.4577...$

$d = 581.6428...$

$= 582\text{ km}$ to nearest km (1)

b) $y \propto \frac{x^3}{r^2}$

$y_1 = \frac{kx^3}{r^2}$ (1)

$y_2 = \frac{k(2x)^3}{(\frac{r}{2})^2}$

$= \frac{8kx^3}{r^2/4}$

$= \frac{32kx^3}{r^2}$

$= 32y_1$

$\therefore y$ is increased by a factor of 32 (1)

c) $2^x = 11 - 3^y$ — ①

$2^{x-2} + 3^{y+2} = \frac{163}{2}$ — ②

From ②:

$\frac{2^x}{4} + 3^y \times 9 = \frac{163}{2}$ — ③ (1)

Sub ① into ③ $\frac{11 - 3^y}{4} + 3^y \times 9 = \frac{163}{2}$

$11 - 3^y + 3^y \times 36 = 326$

$35 \times 3^y = 315$

$3^y = 9$

$y = 2$ (1)

Sub into ①

$2^x = 11 - 9$

$= 2$

$\therefore x = 1$ (1)

$\therefore x = 1, y = 2$

d) Prove $\log_{b^4} x^2 = \log_b \sqrt{x}$

LHS $= \log_{b^4} x^2$

$= \frac{\log_b x^2}{\log_b b^4}$ (1)

$= \frac{2\log_b x}{4\log_b b}$

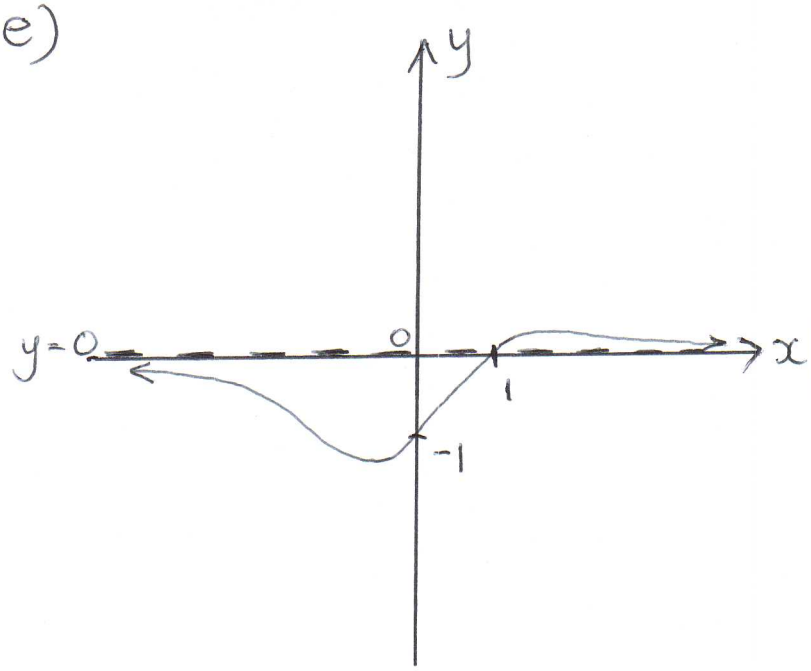
$= \frac{1}{2}\log_b x$ (1)

$= \log_b x^{1/2}$

$= \log_b \sqrt{x}$ (1)

$=$ RHS

e)



(1) shape
(1) x-intercept
(1) y-intercept
(1) asymptote.

f) Remainder will be of the form $ax+b$ (1)

$\therefore P(x) = Q(x)(x+4)(x-3) + ax+b$

$P(-4) = a(-4)+b$

$= 11$

$\therefore -4a+b = 11$ —①

$P(3) = 3a+b$

$= -3$

$\therefore 3a+b = -3$ —②

(1)

① − ②

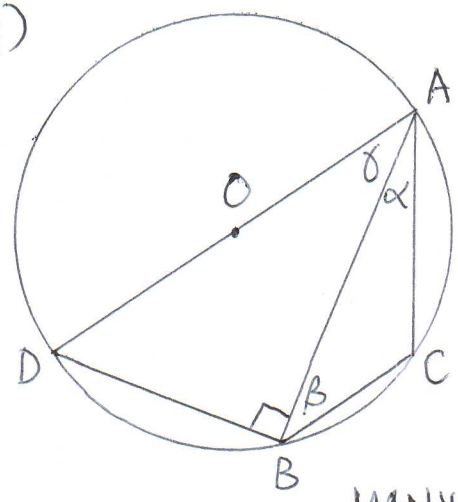
$-7a = 14$

$a = -2, \ b = 3$

(1)

$\therefore$ remainder is $-2x+3$

g)



Construct BD.

$\angle ABD = 90°$ (angle in a semicircle) (1)

$\angle DAC + \angle CBD = 180°$ (opposite angles of cyclic quadrilateral ACBD are supplementary) (1)

$\therefore \gamma + \alpha + \beta + 90° = 180°$

$\therefore \alpha + \beta + \gamma = 90°$

MANY STUDENTS DREW THE DIAGRAM BUT DID NOT USE IT!

Question 14

a) Prove $\frac{\cos\theta}{1-\tan\theta} + \frac{\sin\theta}{1+\cot\theta} = \sin\theta + \cos\theta$

Method 1 Simplifying $\tan\theta$ and $\cot\theta$

LHS

$$\frac{\cos\theta}{1-\frac{\sin\theta}{\cos\theta}} + \frac{\sin\theta}{1-\frac{\cos\theta}{\sin\theta}}$$

$$= \frac{\cos\theta}{\frac{\cos\theta-\sin\theta}{\cos\theta}} + \frac{\sin\theta}{\frac{\sin\theta-\cos\theta}{\sin\theta}}$$

✓ simplifying $\tan\theta$ to $\frac{\sin\theta}{\cos\theta}$ and $\cot\theta$ to $\frac{\cos\theta}{\sin\theta}$

$$= \frac{\cos^2\theta}{\cos\theta-\sin\theta} - \frac{\sin^2\theta}{\cos\theta-\sin\theta}$$

✓ getting $\cos^2\theta$ and $\sin^2\theta$ and changing signs of sin and cos

$$= \frac{\cos^2\theta-\sin^2\theta}{\cos\theta-\sin\theta}$$

$$= \frac{(\cos\theta-\sin\theta)(\cos\theta+\sin\theta)}{\cos\theta-\sin\theta}$$

✓ simplifying $\cos^2\theta-\sin^2\theta$ as $(\cos\theta-\sin\theta)(\cos\theta+\sin\theta)$ and cancelling

$$= \cos\theta+\sin\theta$$

$$= \text{RHS}.$$

Method 2

LHS

$$= \frac{\cos\theta(1-\cot\theta)+\sin\theta(1-\tan\theta)}{(1-\tan\theta)(1-\cot\theta)}$$

expand

$$= \frac{\cos\theta-\frac{\cos^2\theta}{\sin\theta}+\sin\theta-\frac{\sin^2\theta}{\cos\theta}}{1-\frac{\cos\theta}{\sin\theta}-\frac{\sin\theta}{\cos\theta}+1}$$

multiply $\times(\sin\theta)(\cos\theta)$

$$= \frac{\cos^2\theta\sin\theta-\cos^3\theta+\sin^2\theta\cos\theta-\sin^3\theta}{2\cos\theta\sin\theta-\sin^2\theta-\cos^2\theta}$$

$$= \frac{\cos^2\theta(\sin\theta-\cos\theta)-\sin^2\theta(\sin\theta-\cos\theta)}{-(\sin^2\theta+2\sin\theta\cos\theta+\cos^2\theta)}$$

$$\frac{(\cos^2\theta - \sin^2\theta)(\sin\theta - \cos\theta)}{-(\sin\theta - \cos\theta)^2}$$

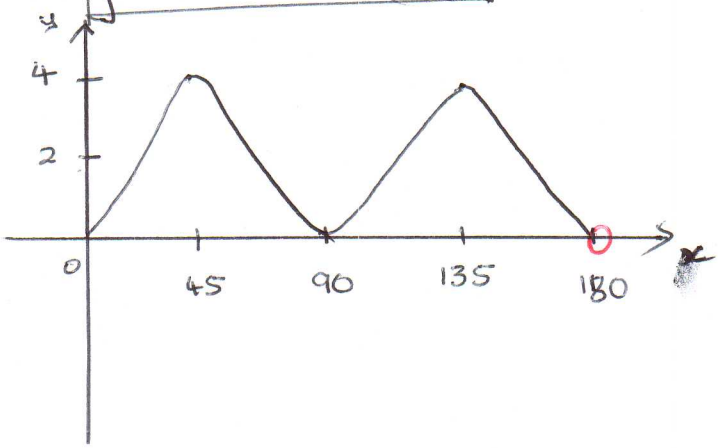
$$= \frac{(\cos\theta + \sin\theta)(\cos\theta - \sin\theta)(\sin\theta - \cos\theta)}{-(\sin\theta - \cos\theta)(\sin\theta - \cos\theta)}$$

$$= \sin\theta + \cos\theta$$

$$= \text{RHS}.$$

b)

$y = 2 - 2\cos(4x)$



✓ domain from $0^\circ \leq x \leq 180$

✓ Range from $0 \leq y \leq 4$

✓ inverted cosine graph

✓ Two cosine graphs in the domain

c) $P(x) = -x^4 + 5x^3 + 4x^2 - 44x + 48$

(i) $P(2) = -16 + 40 + 16 - 88 + 48$

$= 0 \quad \therefore (x-2)$ is a factor. ✓

$P(4) = -256 + 320 + 64 - 176 + 48$

$= 0 \quad \therefore (x-4)$ is a factor ✓

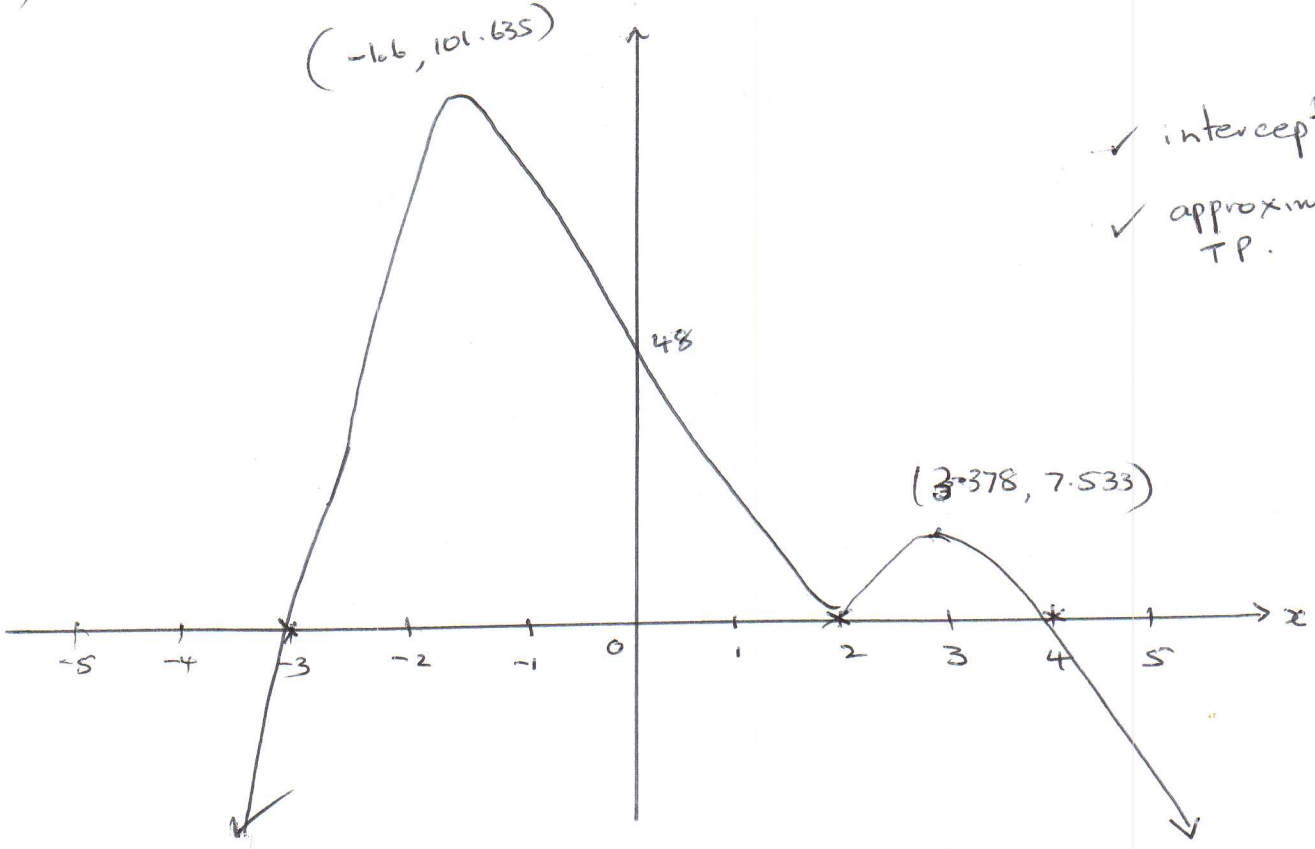
(ii) $(x-2)(x-4) = x^2 - 6x + 8$

$$\begin{array}{r} -x^2 - x + 6 \\ x^2 - 6x + 8 \overline{)\ -x^4 + 5x^3 + 4x^2 - 44x + 48} \\ \underline{-x^4 + 6x^3 - 8x^2} \\ -x^3 + 12x^2 - 44x \\ \underline{-x^3 + 6x^2 - 8x} \\ 6x^2 - 36x + 48 \\ \underline{6x^2 - 36x + 48} \\ 0 \end{array}$$

Factors : $-(x-2)(x-4)(x+3)(x-2)$

$= -(x-2)^2(x+3)(x-4)$

(iii)

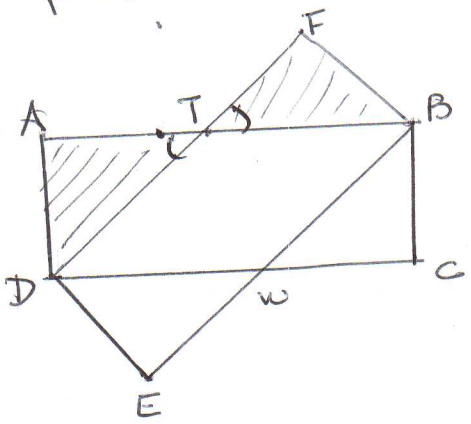


✓ intercepts

✓ approximate TP.

Note y intercept ($y = 48$) is not the turning point.

d) (i)



In $\triangle ADT$ and $\triangle FBT$

$\angle DAT = \angle BFT = 90^\circ$ (angle of rectangle)

$\angle ATD = \angle FTB$ (vertically opposite angles) ✓

$AD = FB = 3$ (corresponding sides of congruent rectangle) ✓

$\therefore \triangle ADT \equiv \triangle FBT$ (AAS)

$TB = 7 - AT$

Since $TB = TD$ (corresponding sides in congruent triangle) ✓

$TD = 7 - AT$

In triangle DAT (by pythagoras theorem) ✓

$AD^2 + AT^2 = DT^2$

$3^2 + AT^2 = (7 - AT)^2$

$9 + AT^2 = 49 - 14AT + AT^2$

$14AT = 40$ ✓

$AT = \frac{40}{14}$

$\therefore AT = \frac{20}{7}$

(ii) $BT \parallel DW$ (opposite sides of rectangle ABCD are parallel)
$DT \parallel WB$ (opposite sides of rectangle DEBF are parallel)
∴ DWBT is a parallelogram (two pairs of opposite sides are parallel)

$$\therefore \text{Area} = 3 \times \left(7 - \frac{20}{7}\right) \quad \checkmark$$

$$= \frac{87}{7}$$

∴ Area is $\frac{87}{7}$ unit^2 ✓

QUESTION 15

a) (i) $P(4 \text{ won}) = \left(\frac{1}{60}\right)^4$

$= \frac{1}{12960000}$ (1)

(ii) $P(\text{at least one}) < 1 - \left(\frac{59}{60}\right)^n$ 1 for $\left(\frac{59}{60}\right)^n$

$1 - \left(\frac{59}{60}\right)^n \leq 0.98$

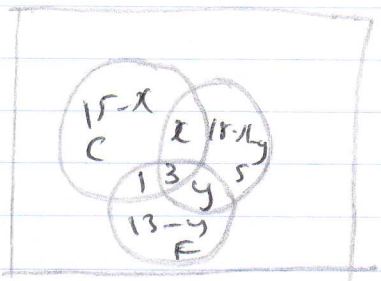
$.02 \leq \left(\frac{59}{60}\right)^n$

$\log_{10} 0.02 \leq n \log_{10} \frac{59}{60}$ 1 for answer answer only no workings 1

$n \geqslant \frac{\log_{10} 0.02}{\log_{10} \frac{59}{60}}$

$\geqslant 232.75$

233 consecutive draws will be needed.



$15 - x + x + 3 + 1 + y + 13 - y + 18 - x - y + 4 = 43$

$54 - x - y = 43$

$-(x + y) = -11$

$x + y = 11$

$\therefore 18 - 11 = 7$

(ii) $P(\text{sprite}) = \frac{7}{43}$.

1 for venn diagram some progress to an answer
1 for correct answer.

(ii) 1 for correct answer

Question 15

e) (i) $2x^3 + 3x^2 - 12 = 0$

$\alpha + \beta + \gamma = -\frac{3}{2}$ 1mark.

$\alpha\beta + \alpha\gamma + \beta\gamma = 0$ 1mark.

$\alpha\beta\gamma = 6$

(1) $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma} = \frac{\beta\gamma + \alpha\gamma + \alpha\beta}{\alpha\beta\gamma}$.

$= \frac{0}{6}$ 1mark.

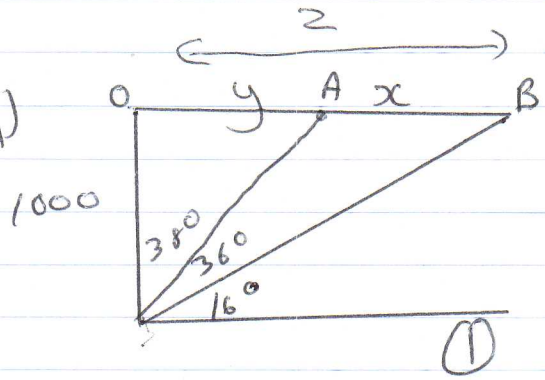
$= 0$ an answer of 0 without showing numbers 1.

(ii) $(\alpha+\beta+\gamma)^2 = (\alpha+\beta+\gamma)^2 - 2(\alpha\beta + \alpha\gamma + \beta\gamma)$

$= \left(\frac{-3}{2}\right)^2 - 2(0)$

$= \frac{9}{4}$. 1mark.

(d)



1

some drew angle of depression

$\tan 38° = \frac{y}{1000}$

$y = 781.29\,m$ (1)

$\tan 74° = \frac{z}{1000}$

$z = 3487.41$

$x = z - y$ (1)

other methods used give $x = 2706.13$.

(e) (i) $\frac{\sin\theta}{20} = \frac{\sin 25}{10}$ let $\angle ABB = \theta$ (1)

$\theta = 122°18'$ as angle must be obtuse (1)

QUESTION 5

(i) $BD = BC$ (given)

$B\hat{D}C = 57°42'$

$\angle DBC = 64°36'$ (angle sum of triangle) (1)

$$\frac{BC}{\sin 64°36'} = \frac{10}{\sin 57°42'}$$

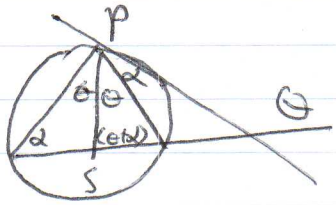
$$BC = \frac{10 \sin 64°36'}{\sin 57°42'} \quad (1)$$

could use cosine rule as well

$$= 10.69.$$

Students who realised that angle in (i) was obtuse were successful.
Many students got $122°18'$ for $B\hat{D}C$
They ignored $\angle BCD$ completely.
Students need to think about whether their answer is realistic

f)



Let $Q\hat{P}R = \alpha$.

$PTR = \alpha$ (angle between tangent and chord equals angle in alternate segment) (1)

$P\hat{S}R = \theta + \alpha$ (exterior angle of $\triangle PST$ equals sum of opposite interior angles) (1)

$\angle QPS = \theta + \alpha$ (adjacent angles)

$PQ = SQ$ (equal sides are opposite equal angles in $\triangle PQS$) (1)