2011
Preliminary Course
FINAL EXAMINATION
Monday, September 12th

Mathematics

General Instructions

- Reading Time - 5 minutes.
- Working Time – 3 hours.
- Write using a black or blue pen.
- Approved calculators may be used.
- All necessary working should be shown for every question.
- Begin each question in a new booklet.

Total marks (**120**)

- Attempt Questions 1- 10.
- All questions are of equal value.

Outcomes to be Assessed:

A student:

P2 provides reasoning to support conclusions which are appropriate to the context.

P3 performs routine arithmetic and algebraic manipulation involving surds, simple rational expressions and trigonometric identities.

P4 chooses and applies appropriate arithmetic, algebraic, graphical, trigonometric and geometric techniques.

P5 understands the concept of a function and the relationship between a function and its graph.

Question 1 **(12 Marks)** Use a Separate Booklet **Marks**

a) Evaluate correct to 1 decimal place $\frac{\sqrt[5]{32}}{6.1+3.2}$ **2**

b) Factorise completely: $xy-2yz+4x-8z$ **2**

c) Simplify: $\frac{x}{4}-\frac{3x+1}{6}$ **3**

d) Write 0.00014 in scientific notation **1**

e) Find the value of b if $11+2\sqrt{18}=11+\sqrt{b}$ **1**

f) Factorise $4m^2-9$ **1**

g) Solve for x: $\frac{1}{x}-3=\frac{1}{2x}$ **2**

Question 2 **(12 Marks)** Start a new booklet **Marks**

a) Express $0.4\dot{6}$ as a common fraction. **2**

b) Mr Dandy's water rate for his property has increased by 8%. The new water rate for his property is now \$256. Find the old water rate (correct to the nearest dollar) **2**

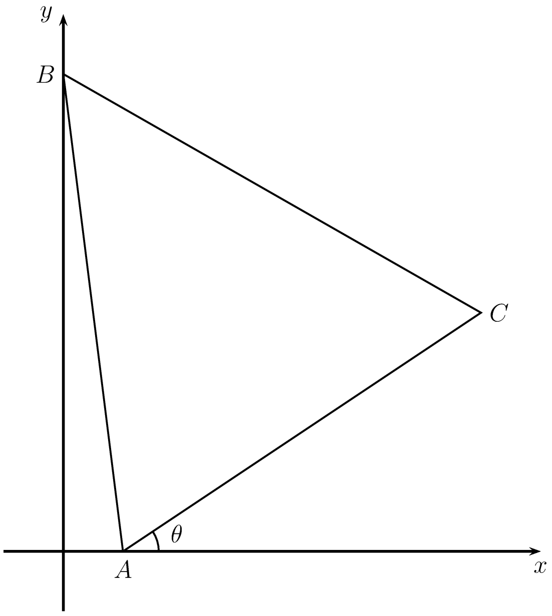
c) Solve the inequality $|2-5x|<7$. **2**

d) Express $\dfrac{1+\sqrt{3}}{5-2\sqrt{3}}$ as a fraction with a rational denominator. **2**

e) Solve the equation $2\cos\beta=-\sqrt{3}$ for $0^\circ\le\beta\le 360^\circ$ **2**

f) Find the exact value of $\tan 120^o$. **2**

Question 3 **(12 marks)** Start a new booklet **Marks**



Consider the three points A, B and C on the number plane as shown above.
The equation of the line AC is given by $2x - 3y - 2 = 0$ and the equation of the line BC is given by $4x + 7y - 56 = 0$. The point B has coordinates (0, 8).

a) Find the coordinates of the point A. **1**

b) Show that the point C has the coordinates (7, 4). **2**

c) Find the exact distance of AC in simplest form. **2**

d) The line AC makes an angle θ with the positive x-axis. Calculate θ to the nearest minute. **2**

e) Find the equation of the line which is perpendicular to AC and passes through B. **2**

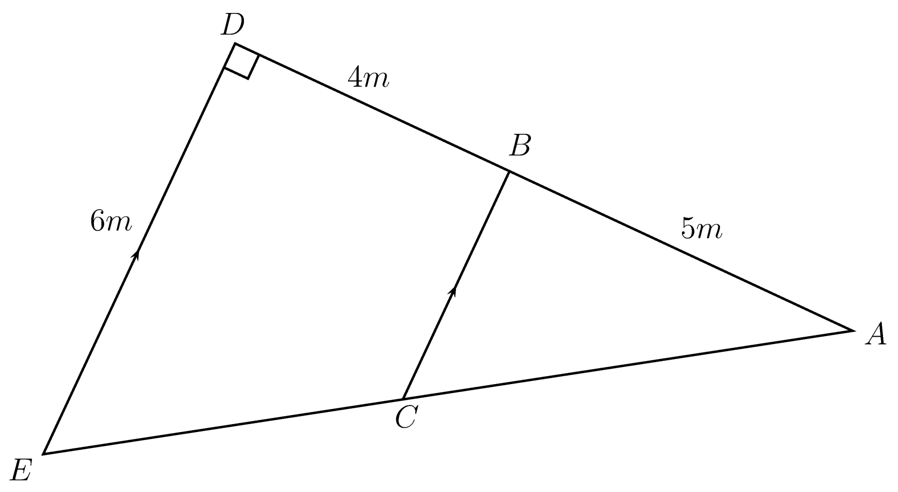
f) Show that the perpendicular distance from B to AC is $2\sqrt{13}$ **2**

g) Calculate the area of ΔABC. **1**

Question 4 **(12 Marks)** Start a new booklet **Marks**

a) Factorise and simplify $\frac{x^3 - 8}{2x^2 - 3x - 2}$ **3**

b) In the diagram below triangle *ADE* is right angled at *D*. *BC* is parallel to *DE*.
AB = 5*m*, *DB* = 4*m* and *DE* = 6*m*.



i) Prove that ΔABC is similar to ΔADE. **2**

ii) Find the length of *BC* **2**

iii) Find the area of *DBCE*. **1**

iv) Show that $AB \times EC = AC \times BD$, giving reasons. **2**

c) State the domain and range of the curve with equation $y = \frac{3}{x} + 1$ **2**

Question 5 **(12 Marks)** Start a new booklet **Marks**

a) The sum of the interior angles of a regular polygon is 2520°

i) Show that the polygon has sixteen sides. **1**

ii) Find the size of each interior angle to the nearest minute. **1**

b) A given parabola has the equation $y = x^2 - 4x - 12$

i) By completing the square, write the equation of the parabola in the form $y = (x-h)^2 + k$ **1**

ii) State the coordinates of the vertex. **1**

iii) Hence or otherwise find the x-intercepts of the parabola $y = x^2 - 4x - 12$. **2**

iv) Sketch the parabola showing all relevant features. **2**

c) The equation $2x^2 - 7x + 12 = 0$ has roots α and β. Find the value of:

i) $\alpha + \beta$ **1**

ii) $\alpha\beta$ **1**

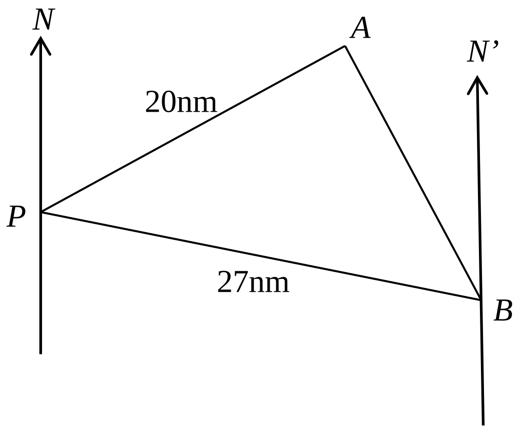
iii) $\alpha^2 + \beta^2$ **2**

Question 6 **(12 Marks)** Start a new booklet **Marks**

a) Find the value of a if $\tan 15^0 = \cot(a+30)^0$ **1**

b) Solve for p: $2^{p+2} = 16$ **2**

c) A ship A has sailed 20 nautical miles from a port P on a bearing of 055^o.
Ship B has sailed 27 nautical miles from port P on a bearing of 115^o.



i) Copy the diagram above and mark all given information. **1**

ii) Show that the angle $\angle APB = 60^o$. **1**

iii) Calculate the distance between the two ships to the nearest nautical mile. **2**

iv) Show that $\angle ABP = 46^o$ correct to the nearest degree. **2**

v) Find the bearing of A from B. **1**

d) If $f(x) = x^2$ and $g(x) = 2x+1$, find $f(g(2))$. **2**

Question 7 **(12 Marks)** Start a new booklet **Marks**

a) Solve $4^x - 9(2^x) + 8 = 0$ **3**

b) Consider two functions $f(x)$ and $g(x)$.

i) If $f(x) = g(x) + g(-x)$ show that $f(x)$ is an even function. **1**

ii) Is $f(x) = g(x) - g(-x)$ also an even function? Give reasons for your answer. **1**

c) i) Sketch the graph of $y = |x-4| - 2$ showing all important features. **2**

ii) On the same number plane shade the region where **2**

$$y \geq |x-4| - 2 \text{ and } y < 2$$

d) Determine the value of a so that $y = ax^2 + 2x + a$ is positive definite. **3**

Question 8 **(12 Marks)** Start a new booklet **Marks**

a) If $\tan\theta = \dfrac{7}{24}$ and $180 \le \theta \le 360^o$, find the exact value of $\sin\theta$ **2**

.

b) A function is defined by the rule:

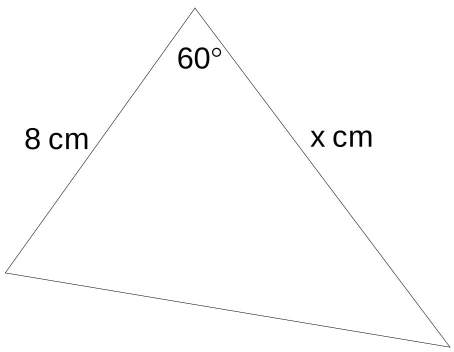
$$f(x) = \begin{cases} \dfrac{1}{x}, & x < 0 \\ x+2, & x \ge 0 \end{cases}$$

Find:

(i) $f(-3)$ **1**

(ii) $f(b^2)$ **1**

c) Calculate the value of *x* in the diagram below, if the area of the triangle is $22\sqrt{3}\ \text{cm}^2$. **2**



d) The equation of a circle is $(x-1)^2 + (y+2)^2 = r^2$

(i) Write down the coordinates of the centre of this circle. **1**

(ii) If $x + y = 4$ is a tangent to this circle, find the exact value of *r*. **2**

e) Show that $\tan\theta - \dfrac{\sin^3\theta}{\cos\theta} = \sin\theta\cos\theta$ **3**

Question 9 **(12 Marks)** Start a new booklet **Marks**

a) *ABCD* is a quadrilateral with external angles $\alpha,\ \beta,\ \delta,\ \varphi$. **2**
Explain why $\sin(\alpha+\beta+\delta+\varphi)=0$.

b) i) Sketch the graph $y=\cos x$ for $0^o \le x \le 360^o$ **1**

ii) On the same number plane sketch $y=\dfrac{1}{2}$ **1**

iii) How many solutions are there for $\cos x=\dfrac{1}{2}$ in the domain $0^o \le x \le 360^o$ **1**

iv) For what values of *k* will $\cos x = k$ have no solutions in the domain $0^o \le x \le 360^o$? **1**

c) Solve $4\sin^2\theta - 3 = 0$ for θ, where $0^\circ \le \theta \le 360^\circ$. **3**

d) Given that $x^2+4x+5 \equiv (x+a)^2+b^2$ find all possible values for *a* and *b*. **3**

Question 10 (12 Marks) Start a new booklet **Marks**

a) Find the value(s) of k for which the equation $x^2 + (k+3)x + 4k = 0$ has:

i) one root equal to 1 **1**

ii) roots which are equal but opposite in sign **2**

iii) equal roots **2**

iv) no real roots **1**

b) In the diagram below, *ABCD is* a square. *X*, *Y* and *Z* are points on the sides *AB*, *BC* and *CD* respectively such that $XB = YC = ZD$.

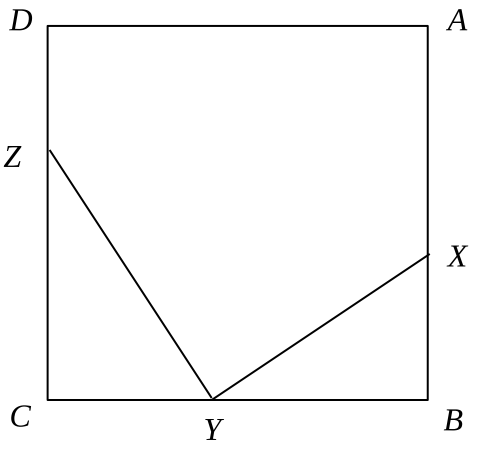


DIAGRAM
NOT TO SCALE

Copy the diagram into your writing booklet.

i) Prove that $\Delta BXY \equiv \Delta CYZ$ **3**

ii) Hence or otherwise prove that $XY = YZ$ **1**

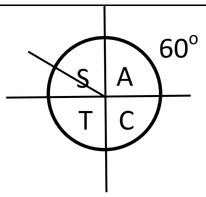
iii) Deduce that $\angle XYZ = 90^o$ **2**

End of Paper

Solutions to Year 11 Mathematics 2011 Preliminary Examination

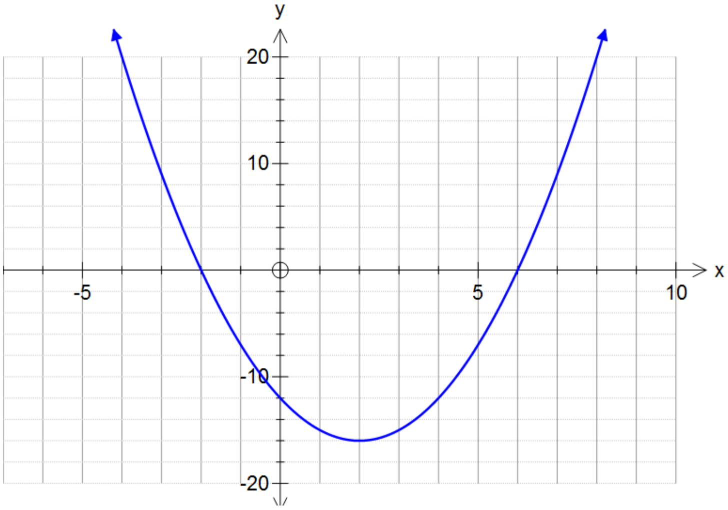
Question 1	Marking Criteria
a) $\dfrac{\sqrt[5]{32}}{6.1+3.2}=0.215...$ $=0.2$ (1 decimal place)	2 - correct answer 1 - correct calculator read out, but not rounded correctly
b) $xy-2yz+4x-8z$ $=y(x-2z)+4(x-2z)$ $=(y+4)(x-2z)$	2 – correct solution 1 – attempt towards solution using some factorising
c) $\dfrac{x}{4}-\dfrac{3x+1}{6}$ $=\dfrac{3x}{12}-\dfrac{6x+2}{12}$ $=\dfrac{-3x-2}{12}$ $=-\dfrac{3x+2}{12}$	3 – correct solution $=\dfrac{-3x-2}{12}$ 2 – solution with one error 1 – expressing both fractions with a common denominator
d) 1.4×10^{-4}	1 – correct answer
e) $4\times18=72$ $b=72$	1 – correct answer
f) $4m^2-9$ $=(2m+3)(2m-3)$	1 – correct factorising
g) $\dfrac{1}{x}-3=\dfrac{1}{2x}$ $2-6x=1$ $-6x=-1$ $x=\dfrac{1}{6}$	2 – correct solution 1 – correctly removing denominators or one mistake in otherwise correct solution 1 – if multiplying equation through with $2x^2$ and getting the solutions $x=0$ $x=\dfrac{1}{6}$ but not realising that the equation is not defined for $x=0$

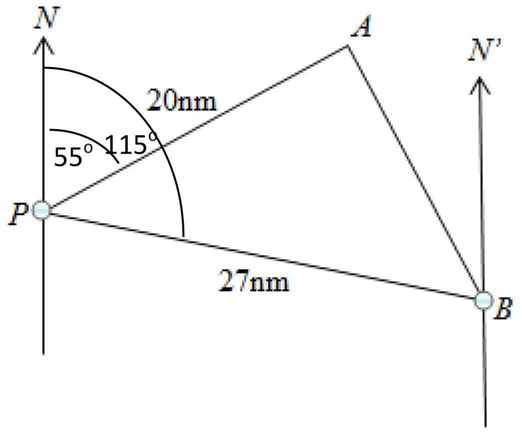
Question 2	
a) let $x = 0.466666....$ $10x = 4.666....$ $-\ x = 0.4666...$ $9x = 4.2$ $x = \frac{4.2}{9}$ $x = \frac{42}{90}$ $x = \frac{7}{15}$	2 – correct solution 1 – attempt at correct solution
b) Let $x =$ old water rate $1.08x = \$256$ $x = \frac{\$256}{1.08}$ $= \$237.07...$ $= \$237(\text{nearest dollar})$	2 – correct solution 1 – attempt at correct solution or answer not rounded to nearest dollar
c) $\lvert 2-5x \rvert < 7$ $2-5x<7$ or $-2+5x<7$ $-5x<5 \qquad 5x<9$ $x>-1 \qquad x<\frac{9}{5}$ $\therefore\ -1<x<\frac{9}{5}$	2 – correct solution 1 - solution with one error but solution must not be over simplified
d) $\frac{1+\sqrt{3}}{5-2\sqrt{3}} \times \frac{5+2\sqrt{3}}{5+2\sqrt{3}}$ $= \frac{(1+\sqrt{3})(5+2\sqrt{3})}{25-12}$ $= \frac{5+2\sqrt{3}+5\sqrt{3}+6}{13}$ $= \frac{11+7\sqrt{3}}{13}$	2 – correct solution 1 – multiplying with conjugate surd

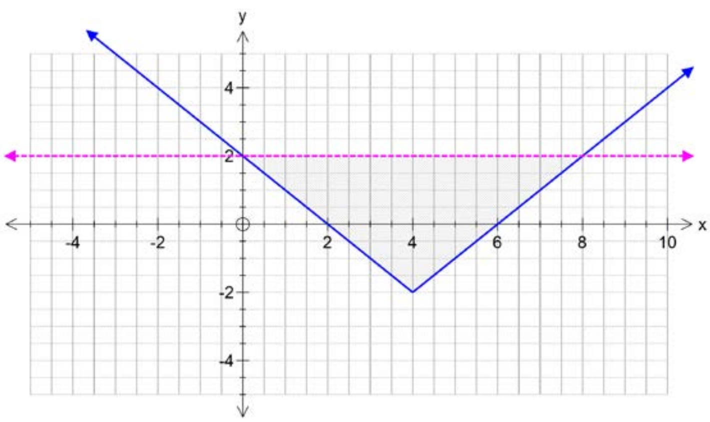
e) $2\cos\beta = -\sqrt{3}$ $\cos\beta = -\frac{\sqrt{3}}{2}$ $\beta = 180^\circ - 30^\circ, 180^\circ + 30^\circ$ $= 150^\circ, 210^\circ$	2 – correct solution 1 – one angle correct or finding acute angle of 30°
f) $\tan 120^o = -\tan 60^o$ $= -\sqrt{3}$  	2 – correct solution 1 – solution with one error
Question3	
a) Let $y=0$, then $2x-2=0$ $x=1$ $A=(1,0)$	1 – correct answer
b) either show *C* lies on both lines by substitution or solve simultaneously: (1) $2x-3y-2=0$ (2) $4x+7y-56=0$ $x=7,\ y=4$	2 – correct solution 1 – solution with one error Or 1 correct substitution
c) $A=(1,0)\quad C=(7,4)$ $d=\sqrt{(7-1)^2+(4-0)^2}$ $d=\sqrt{52}$ $d=2\sqrt{13}$	2 – correct solution 1 – correct substitution into formula Or correct solution but surd not simplified
d) $m_{AC} = \frac{2}{3}$ $\tan\theta = \frac{2}{3}$ $\theta = 33.69006...$ $\theta = 33°41'$	2 – correct angle to the nearest minute 1 – correct gradient of *AC* found

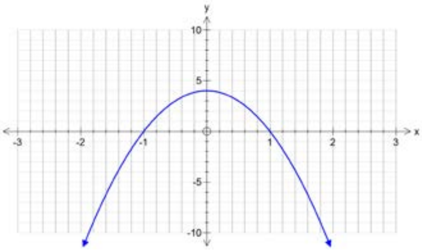
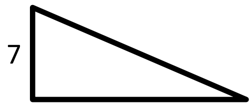
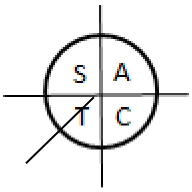
e) $m_{AC} = \frac{2}{3}$, perpendicular gradient $= -\frac{3}{2}$ $B = (0,8)$, using point gradient form $y - 8 = -\frac{3}{2}(x - 0)$ $2y - 16 = -3x$ $3x + 2y - 16 = 0$	2 – Correct equation of straight line in any form 1 - correct perpendicular gradient
$d = \frac{\lvert 2\times 0 - 3\times 8 - 2\rvert}{\sqrt{2^2 + 3^2}}$ $= \frac{\lvert -26\rvert}{\sqrt{13}}$ f) $= \frac{26}{\sqrt{13}} \times \frac{\sqrt{13}}{\sqrt{13}}$ $= \frac{26\sqrt{13}}{13}$ $= 2\sqrt{13}$	2 – correct solution 1 – correct substitution into formula
$A = \frac{1}{2} \times 2\sqrt{13} \times 2\sqrt{13}$ $= 26 \text{ units}^2$	1 – correct answer
Question 4	
a) $\frac{x^3 - 8}{2x^2 - 3x - 2}$ $= \frac{(x-2)(x^2 + 2x + 4)}{(2x+1)(x-2)}$ $= \frac{(x^2 + 2x + 4)}{(2x+1)}$	3 – correctly factorised and simplified 2 – correctly factorised but not simplified 1 – correctly factorised numerator or denominator
b) (i) In triangles ΔABC and ΔADE $\angle A$ is common $\angle ABC = \angle ADE$ (corresponding angles on parallel lines, DE//BC) $\therefore \Delta ABC$ is similar to ΔADE (equiangular)	2 – correct proof with all reasons given 1 – correct proof but not all reasons given
ii) $\frac{BC}{6} = \frac{5}{9}$ (matching sides in similar triangles in the same ratio) $BC = \frac{30}{9}$ $= 3.\dot{3}m$	2 – correct solution with correct reason 1 – correct ratio given

iii) *DBCE* is a trapezium: $A=\frac{4m}{2}\left(6m+3.\dot{3}m\right)$ $=18.\dot{6}m^2$	1 – correct answer
iv) $\frac{AB}{BD}=\frac{AC}{CE}$ (intercepts on transversals cut by parallel lines in same ratio) $\therefore AB\times EC = AC\times BD$	2 – correct sides in ratio statement with correct reason 1 – incorrect reason OR incorrect sides in ratio statement
c) Domain: all real *x*, $x\neq 0$ Range: all real *y*, $y\neq 1$	2 – correct domain and range 1 – correct domain or range
Question 5	
a)i) $2520=(n-2)\times 180$ $n=16$	1 – correct solution
ii) $2520\div 16=157°30'$	1 – correct answer
b)i) $y=x^2-4x-12$ $y=(x^2-4x+4)-4-12$ $y=(x-2)^2-16$	1- correct expression
ii) *V*(2, -16)	1 – correct coordinates
iii) Let *y* = 0 $(x-2)^2-16=0$ $(x-2)^2=16$ $(x-2)=\sqrt{16}$ $x-2=\pm 4$ $x=6$ or $x=-2$	2 – calculating both roots correctly 1 – attempt towards finding roots, or factorising original equation $y=(x-6)(x-2)$

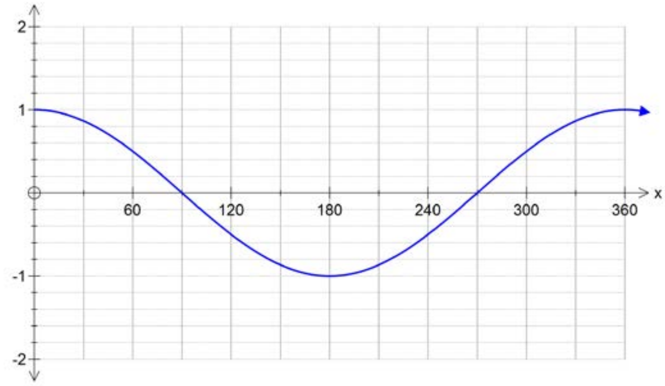
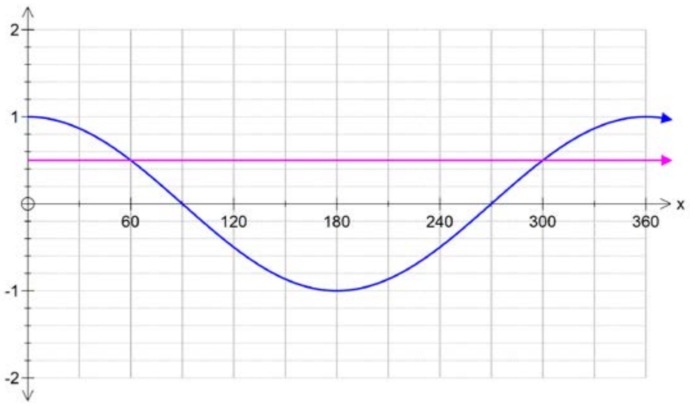
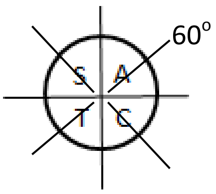
iv) 	2 – correct graph showing all intercepts and coordinates of vertex 1 - correct graph with some of the above information
c) i) $\alpha+\beta=\frac{--7}{2}$ $=\frac{7}{2}$	1 – correct answer
ii) $\alpha\beta=\frac{12}{2}$ $=6$	1 – correct answer
iii) $\alpha^2+\beta^2$ $=(\alpha+\beta)^2-2\alpha\beta$ $=(\frac{7}{2})^2-2\times 6$ $=0.25$	2 – correct solution 1 – correct algebraic expression using only sum and product, but wrong numbers substituted or mistake made in evaluation
Question 6	
a) Using $\tan 15°=\cot(90-15°)$ $a=45°$	1 – correct answer

b) $2^{p+2} = 16$ $2^{p+2} = 2^4$ $p + 2 = 4$ $p = 2$	2 – correct solution 1 – Writing 16 to the base 2
c) i) 	1 – correct diagram showing sides and bearings
ii) $\angle APB = \angle BPN - APN$ $= 115° - 55°$ $= 60°$	1 – correct answer
iii) Using cosine rule: $x^2 = 20^2 + 27^2 - 2 \times 20 \times 27 \cos 60°$ $x^2 = 589$ $x = 24.26...$ $= 24\text{nm}$ (nearest nautical mile)	2 – correct solution 1 – correct substitution into formula
iv) Using sine rule: $\frac{\sin\theta}{20} = \frac{\sin 60°}{24}$ $\sin\theta = \frac{\sin 60°}{24} \times 20$ $\sin\theta = 0.72168....$ $\theta = \sin^{-1}(0.72168...)$ $= 46.194...°$ $\theta = 46°$ (nearest degree)	2 – correct solution 1 – correct substitution into formula

v) $180° - 115° = 65°$ (cointerior angles on parallel lines) $65° - 46° = 19°$ Bearing of A from B: $360° - 19° = 341°$	1 – correct bearing
d) $g(2) = 5$ $f(5) = 25$ $f(g(2)) = 25$	2 – correct answer 1 – finding *g*(2)=5 or applying the function *f* correctly.
Question 7	
a) $4^x - 9(2^x) + 8 = 0$ $4^x = (2^x)^2$ Let $2^x = u$ $u^2 - 9u + 8 = 0$ $(u-8)(u-1) = 0$ $u = 8$ or $u = 0$ $2^x = 8$ $\quad 2^x = 1$ $x = 3$ $\quad x = 0$	3 – correct solution 2 – correct substitution and finding of u 1 – correct substitution
b) i) $f(-x) = g(-x) + g(--x)$ $= g(-x) + g(x)$ $= g(x) + g(-x)$ $= f(x)$ Hence *f(x)* is even.	1 – correct answer
ii) $f(-x) = g(-x) - g(--x)$ $= g(-x) - g(x)$ $\neq f(x)$ Hence this function is not even (However it is an odd function since *f(-x)= - f(x)*)	1 – correct answer
c)i)ii)  	i) 2 – correct graph showing all intercepts 1 – graph not showing all intercepts or not to scale ii) 2 – line y=2 drawn correctly (dotted) and correct shading 1 – line drawn correctly or somewhat correct shading from incorrect line, or line not dotted.

d) postive definite means: a>0 and Δ<0 $\Delta = 4 - 4a^2$ $4(1-a^2) < 0$ $(1-a)(1+a) < 0$ $a < -1, \ a > 1$ But $a > 0$ (positive de $\therefore a > 1$ 	3 – correct solution 2 - $\Delta < 0$ solved correctly for *a* 1 – discriminant found and conditions stated
Question 8	
a) $\tan\theta = \frac{7}{24}$  Using right angled triangle Hypotenuse = $\sqrt{7^2 + 24^2}$ $= 25$  $\therefore \sin\theta = -\frac{7}{25}$	2 – correct solution 1 – finding the hypotenuse and finding the sine ratio albeit as a positive 1 – correct answer
b)i) $f(-3) = \frac{1}{-3}$ $= -\frac{1}{3}$	1 – correct answer
ii) $f(b^2) = b^2 + 2$ Since $b^2 \geq 0$	1 – correct answer

c) $A=\frac{1}{2}ab\sin C$ $22\sqrt{3}=\frac{1}{2}8x\sin 60°$ $22\sqrt{3}=4x\frac{\sqrt{3}}{2}$ $22\sqrt{3}=2x\sqrt{3}$ $x=11$	2 – correct answer 1 – correct substitution into area formula
d) i) C= (1, -2)	 1 – correct coordinates
ii) If $x+y=4$ is a tangent to this circle, it must touch the circle in one point only. So the radius must be equal to the perpendicular distance from the centre to the line $x+y=4$ $r=\frac{\lvert 1\times 1+1\times(-2)-4\rvert}{\sqrt{1^2+1^2}}$ $=\frac{5}{\sqrt{2}}$ $=\frac{5\sqrt{2}}{2}$	2 – correct solution 1 – attempt at solution, substituting into perpendicular distance formula
e) $LHS=\tan\theta-\frac{\sin^3\theta}{\cos\theta}$ $=\frac{\sin\theta}{\cos\theta}-\frac{\sin^3\theta}{\cos\theta}$ $=\frac{\sin\theta(1-\sin^2)}{\cos\theta}$ $=\frac{\sin\theta\cos^2\theta}{\cos\theta}$ $=\sin\theta\cos\theta$ $=RHS$	3 – correct proof 2 – substituting $\frac{\sin\theta}{\cos\theta}=\tan\theta$ and factorising numerator 1 – substituting $\frac{\sin\theta}{\cos\theta}=\tan\theta$
Question 9	
a) External angles of a polygon add up to 360° $\sin 360°=0$	2 – correct explanation 1 – realising that external angles add to 360°

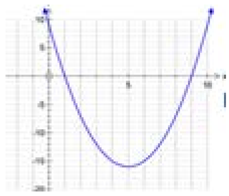
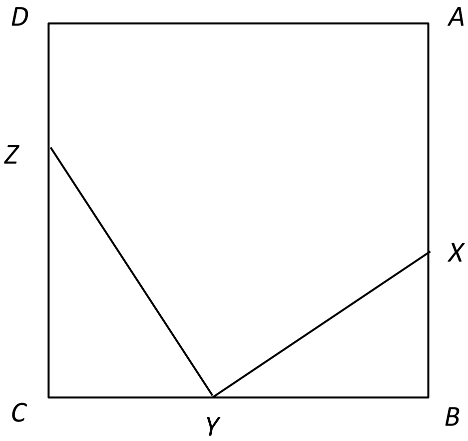
<table>
<tr><td>b)
i)

</td><td>1 – correct graph</td></tr>
<tr><td>ii)

</td><td>1 – correct line</td></tr>
<tr><td>iii) 2 solutions as there are 2 points of intersection</td><td>1 – correct answer</td></tr>
<tr><td>iv) for $k > 1$ or $k < -1$</td><td>1 – correct answer</td></tr>
<tr><td>c)


$4\sin^2\theta - 3 = 0$
$\sin^2\theta = \frac{3}{4}$
$\sin\theta = \pm\frac{\sqrt{3}}{2}$
$\theta = 60°, 120°, 240°, 300°$</td><td>3 – correct solution

2 – finding only the solution in the 1st and 2nd quadrant

1 – achieving $\sin^2\theta = \frac{3}{4}$</td></tr>
<tr><td>d)
$x^2 + 4x + 5 \equiv (x+a)^2 + b^2$
$= x^2 + 2ax + a^2 + b^2$
$= x^2 + 2ax + (a^2 + b^2)$</td><td>3 – correct solution</td></tr>
</table>

Comparing coefficients $2a = 4 \Rightarrow a = 2$ $a^2 + b^2 = 5$ substituting $a = 2$ $2^2 + b^2 = 5$ $b^2 = 1$ $b = \pm 1$ $\therefore a = 2,\ b = \pm 1$ Alternatively substitute $x = 0$ and $x = 1$ into identity to give a set of equations that can be solved simultaneously.	2 – solution with one error 1 – realising that coefficient need to be compared and making an attempt to do so.
Question 10	
a)i) substitute *x* = 1 $1 + (k+3) + 4k = 0$ $5k + 4 = 0$ $k = -\frac{4}{5}$	1 – correct value for *k*
ii) The sum of roots will equal 0 $\alpha + \beta = 0$ $-(k+3) = 0$ $-k - 3 = 0$ $k = -3$	2 – correct solution 1 – stating sum of roots equal to 0 OR stating roots as α and $-\alpha$
iii) equal roots means that the discriminant is equal to zero $\Delta = (k+3)^2 - 4 \times 1 \times 4k$ $(k+3)^2 - 4 \times 1 \times 4k = 0$ $k^2 + 6k + 9 - 16k = 0$ $k^2 - 10k + 9 = 0$ $(k-9)(k-1) = 0$ $\therefore k = 1,\ k = 9$	2 – correct solution 1 – correct substitution into discriminant

iv) no real roots means that the discriminant is negative  $\Delta < 0$ $(k-9)(k-1)=0$ $1 < k < 9$	1 – correct solution
b)  i) In ΔBXY and ΔCYZ $\angle C = \angle B = 90°$ ($ABCD$ is a square) $XB = YC$ (given) ZC=YB (since CD and CB are equal sides of a square and $ZD = YC$) $\therefore \Delta BXY \equiv \Delta CYZ$ (SAS)	3 – correct proof 2 – correct proof but not all reasons given 1 – one valid statement with a reason
ii) $XY = YZ$ (corresponding sides in congruent triangles are equal)	1 – correct reason

iii) Since ΔZCY and ΔXBY are congruent all corresponding angles equal and $\angle ZYC = \angle YXB$ $\angle YXB$ is complementary to $\angle XYB$ (right angled triangle) and hence $\angle ZYC$ is complementary to $\angle XYB$ $\angle XYZ = 180° - (\angle ZYC + \angle XYB)$ (straight angle) $\therefore \angle XYZ = 90°$	2 – correct conclusion drawn with all reasons given 1 – correct conclusion but not fully explained.

Communication Marks:

Q1 no communication marks

Q2 1 mark – part b – Set up of solution
$\text{Let original} = x$
$1.08x = \$256 \text{ etc.}$

Q3 1 mark – part b – setting out using LHS /RHS

Q4 1 mark – part b (iii) – for communicating the area of the shape they are finding or wrote out the formula of the shape they are finding.

Q5 1 mark – part a (ii) – showing correct formula: angle sum = $(n-2)\times 180$
1 mark – part b (iv) – stating that "the x-intercepts are –2 and 6"

Q6 1 mark – part c (ii) – stating that $\angle APB = \angle BPN - \angle APN$
1 mark – part c (iii) – for showing the answer displayed on the calculator before rounding.
1 mark – part c (iv) – for showing "$\theta = \sin^{-1}$" in their solution.

Q7 1 mark – part b – showing substitution of –x clearly
1 mark – part d – stating condition for positive definite

Q8 3 marks – part e – clarity of setting out proof with LHS and RHS

Q9 2 marks – part a – clear statement of exterior angle sum, followed by $\sin 360^0=0$ and hence $\sin(\alpha+\beta+\delta+\gamma)=0$

Q10 1 mark – part a – Stating condition for equal/no real roots
1 mark – part b – Giving reasons at each stage of proofs