



SYDNEY BOYS HIGH SCHOOL
MOORE PARK, SURRY HILLS

Year 10

Yearly Examination 2011

Advanced Mathematics

General Instructions

- Working time – 2 hours
- Write using black or blue pen.
- Approved calculators may be used.
- All necessary working **MUST** be shown in every question if full marks are to be awarded.
- If more space is required, clearly write the number of the **QUESTION** on one of the back pages and answer it there. Indicate that you have done so.
- Clearly indicate your class by placing an X, next to your class

- All answers should be presented in simplest exact form, unless otherwise directed.
- Marks may not be awarded for untidy or badly arranged work.

Examiner: *F.Nesbitt*

NAME:

Class	Teacher	
10 A	Mr McQuillan	
10 B	Mr Boros	
10 C	Ms Ward	
10 D	Ms Kilmore	
10 E	Ms Chen	
10 F	Mr Gainford	
10 G	Mr Hespe	

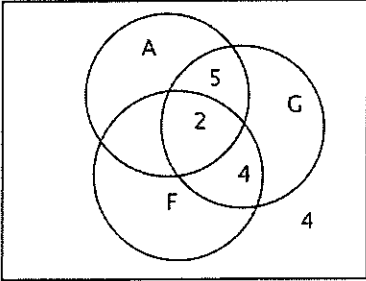
Question	Mark
1	/20
2	/18
3	/18
4	/16
5	/17
6	/20
7	/18
Total	/127

	QUESTION ONE (continued)	Answers	
J	Write $\sqrt{2.36 \times 10^5}$ in scientific notation to two decimal places.		1
K	Sketch the region where $x^2 + y^2 \leq 16$		2
L	Jim bought two tickets in a raffle where 200 tickets were sold. What is the Probability that he won 1 st , 2 nd and 3 rd prizes.		1
M	Write as a single simplified fraction $\frac{ab}{5} + \frac{a}{10}$		1
N	Describe the translation of the circle $x^2 + y^2 = 16$ required to obtain the circle $(x - 4)^2 + (y + 3)^2 = 16$ choosing words from up, down, left or right.		2
O	Find the coordinates of the y-intercept of the parabola $y = x^2 + 3x - 6$		1
P	Write as a simplified fraction with a rational denominator $\frac{2}{1 - \sqrt{5}}$		2
Q	Divide \$850 in the ratio 5 : 4 : 1		1

	QUESTION ONE	Answer	
A	Find the volume of a cone with radius 3.5 cm and height 5 cm correct to 2 decimal places.		1
B	Find the Amount after five years when \$1040 is invested at 6% p.a Compound interest to the nearest dollar.		1
C	Find the value of A if the angle A is in the 2 nd quadrant and $\sin A = \frac{\sqrt{3}}{2}$		1
D	Find the size of each angle in a regular decagon		1
E	Factorise fully: $16m^2 - 25n^2$		1
F	For the polynomial below determine the value of P(3). $P(x) = x^3 - 2x^2 + x - 5$		1
G	Write with positive indices $\frac{x^{-5}y^3}{x^2y^{-4}}$		1
H	Write the gradient of the line $3y = -5x + 2$		1
I	Solve $(3x - 5)(x + 4) = 0$		1

D	<p>(i) Expand and simplify the following polynomial $2x(x^2 - 3x + 2) + 2(x^4 - 5)$</p> <p>and state</p> <p>(ii) The degree (iii) The leading coefficient (iv) The constant term</p>		4
E	<p>What values of y satisfy the inequation</p> $48 \leq 3y - 6 \leq 54$		2
F	<p>A car depreciates at 24% in the first year and 10% p.a. after that. At the end of the third year it is worth \$12312 . Find its original value.</p>		2

	QUESTION TWO	Answers	
A	$\cos A = \frac{9^2 + 8^2 - 7^2}{2 \times 9 \times 8}$ <p>The cosine rule was used to find the cos of the angle A in a triangle.</p> <p>(a) Find the value of the angle A to the Nearest minute</p> <p>(b) Draw a sketch of the triangle including the above values.</p>		3
B	<p>A set of numbers consists of 12, 1, 18, 19, 16, 10, and 4 and one other. What is the missing number if the median of all the numbers is 13?</p>		2
C	<p>Mark bought some toys in bulk for \$$x$ each. He sold them for \$119 each, making a profit of $x\%$.</p> <p>(i) Write a quadratic equation using this information.</p> <p>(ii) Solve the equation to find the value of x</p>		5

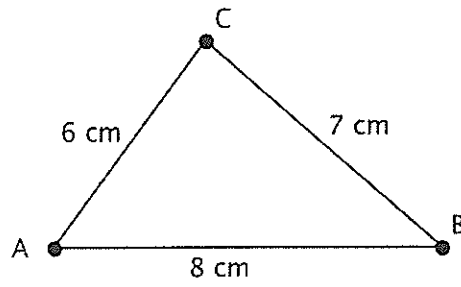
C	Write a polynomial of degree 4 with a leading coefficient of -3 and a constant term of 9.		2
D	Find the coefficient of x^2 in the expansion of $(x + 2)(x^2 + 3x + 8)$		2
E	For what value of k is $(x-2)$ a factor of $x^3 - (k + 3)x^2 + kx + 6$		2
F		<p>Alex is an actor who enjoys golf. He has 35 friends. Some are actors, some play golf and some are female. Two are all three and four fit into none of these categories. Five are male actors who play golf. Four are female golfers who don't act. Seven are female actors. Nineteen of his friends play golf and 16 are actors.</p> <p>(i) Fill in the missing numbers in the diagram.</p> <p>(ii) If a friend is chosen at random what is the probability that he/she is male or plays golf?</p>	3

QUESTION THREE

A	<p>Sketch the following functions marking all intercepts</p> <p>(i) $y = (x - 3)(x + 2)(x - 5)$</p> <p>(ii) $y = -2x^2(x - 2)$</p> <p>(iii) $y = -2(x - 1)^3$</p>		6
B	<p>By first finding the centre and radius, sketch the circle</p> $x^2 + y^2 - 4x + 10y + 28 = 0$		3

D

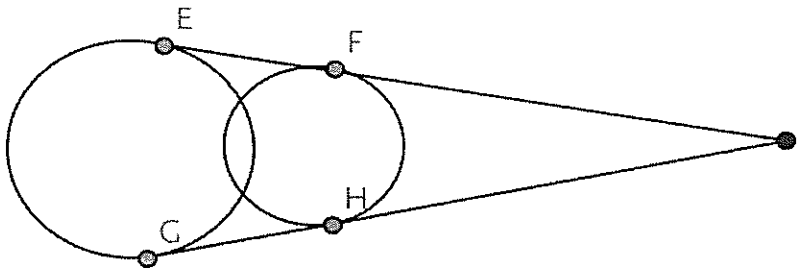
3



- (i) Calculate the size of the angle B correct to the nearest degree.
- (ii) Using your answer in part (i) or otherwise, calculate the area of $\triangle ABC$ to the nearest cm^2 .

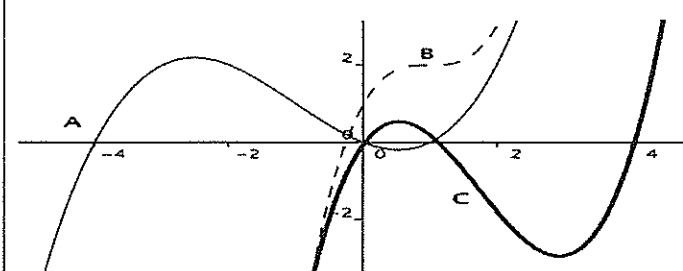
E

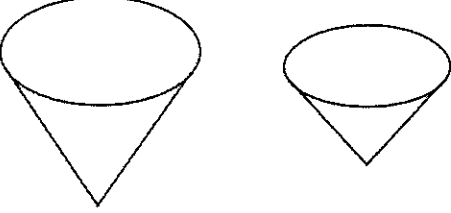
4



EF and GH are common tangents to the two circles above. Show that GEFH is a cyclic quadrilateral

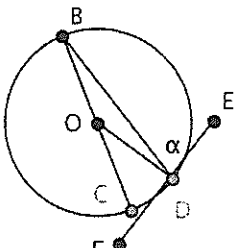
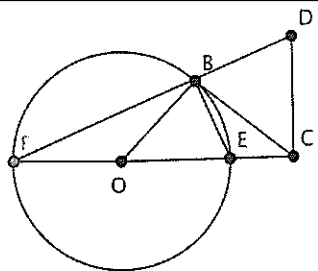
QUESTION FOUR

<p>A</p>	<p>Match each curve to one of the following equations. $y = \frac{1}{2}x(x - 1)(x - 4)$ Write the correct letter next to each equation $y = \frac{1}{6}x(x+4)(x-1)$ $y = (x - 1)^3 + 2$</p> 	<p>3</p>
<p>B</p>	<p>Find the quotient and remainder when the polynomial $3x^4 + 12x^3 + 2x^2 - 16x - 8$ is divided by $x - 3$</p>	<p>4</p>
<p>C</p>	<p>$P(x) = x^3 - 5x + 3$ $Q(x) = 4x^2 + 2x - 9$ (i) Find $P(3) + Q(2)$</p>	<p>2</p>

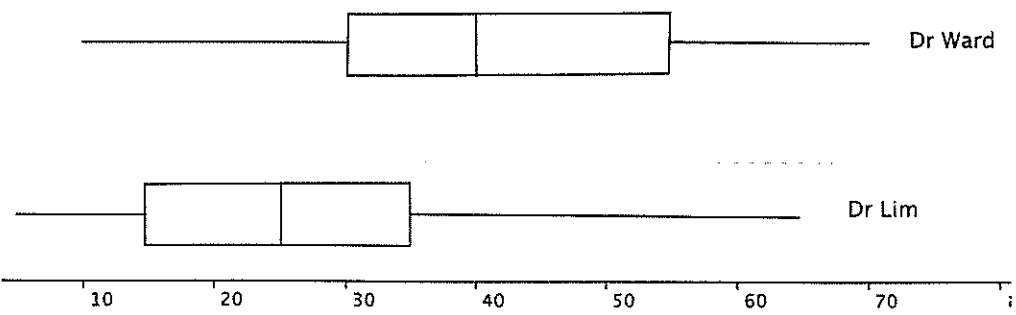
C	<p>If $x^3 - 5x^2 + 7x - 2 = (x - 2)(ax^2 + bx + c)$, find a, b and c</p>	3
D	<p>For the following set of scores, find:</p> <p>4, 4, 9, 6, 1, 4, 2, 2, 4, 9, 4, 8</p> <p>(i) the mean</p> <p>(ii) the inter-quartile range</p>	3
E	<div style="text-align: center;">  </div> <p>Above are two similar cones used for ice cream. The larger cone is 10.5 cm high. If their heights are in the ratio 7:2</p> <p>(i) find the height of the smaller cone.</p> <p>(ii) find the ratio of their volumes.</p>	2

QUESTION FIVE

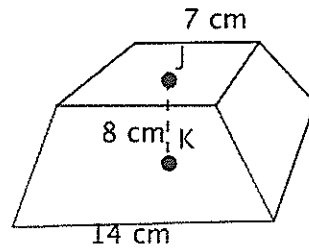
A	<p>For the Polynomial $P(x) = x^3 + 2x^2 - 5x - 6$</p> <ul style="list-style-type: none">(i) Find one factor using the factor theorem.(ii) Use long division to find a quadratic factor.(iii) Use factorisation to find the other linear factors.(iv) Sketch $P(x)$, marking the zeros.	6
B	<p>Below is a sector of a circle with radius 4cm and angle 240°</p> <div data-bbox="718 1232 957 1478" data-label="Diagram"><p>The diagram shows a circular sector. The central angle is labeled as 240°. Two radii are drawn from the center to the arc, and one of them is labeled as 4 cm. The arc is the outer boundary of the sector.</p></div> <ul style="list-style-type: none">(i) Find the radius of the cone formed by joining the radii of the sector.(ii) Find the outside surface area of the cone in terms of π. (the cone has no base)	3

D	 <p>The circle above has centre O and diameter BC. FE is a tangent to the circle at the point D. If the angle $BDE = \alpha$, Find in terms of α</p> <p>(i) The angle ODB</p> <p>(ii) The angle OBD</p> <p>(iii) The angle COD giving brief reasons for each answer.</p>	6
E	<p>Find the values of a and b if $\sqrt{43 - 30\sqrt{2}} = a + b\sqrt{2}$ and a and b are integers.</p>	3
F	 <p>The circle above has centre O and BC is a tangent at B. DC is perpendicular to FC. If the angle $BDC = 62^\circ$, find the size of the angle CBD showing all working. (No proofs required)</p>	3

QUESTION SIX

A	What is the degree of the polynomial $y = (x - 5)(x - 2)^3$	2
B	Find all the solutions of the equation $(x^2 + 2x - 3)^2 + 2(x^2 + 2x - 3) - 3 = 0$	3
C	<p>The box and whisker plot below shows the number of minutes patients waited for Dr Lim and Dr Ward.</p>  <p>Find;</p> <p>(i) the range of waiting times for Dr Ward _____</p> <p>(ii) the inter-quartile range for Dr Lim _____</p> <p>(iii) the median waiting time for Dr Ward. _____</p>	3

C The solid below which is 8 cm high is the lower part of a right square pyramid which was 16 cm high before the top was removed. Find:

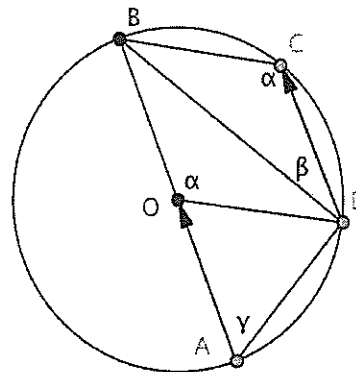


(a) the volume of the solid

(b) the surface area of the solid

5

D

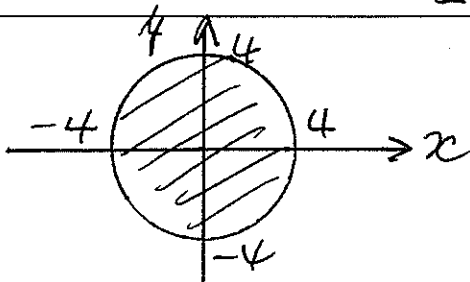


In the circle above the diameter AB is parallel to the chord CD. The angles BOD and BCD are equal. Find the sizes of the angles BOD, OAD and BCD, giving reasons.

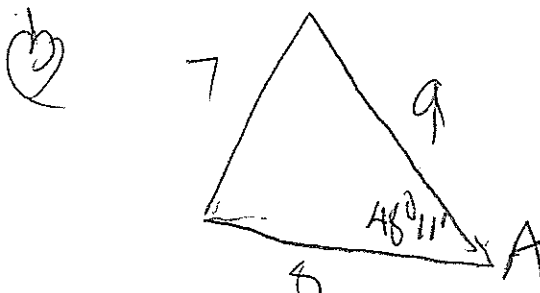
4

QUESTION SEVEN

A	<p>Use the equation below to convert a reducible rate of 12% p.a. to a flat rate and calculate the monthly repayment on a loan of \$175 000 taken at 12% p.a. reducible over 10 years.</p> $F = \frac{(1+R)^n(nR-1)+1}{n(1+R)^n-1}$ <p>where F is the flat rate per month, R is the reducible rate per month and n is the number of monthly instalments.</p>	4
B	<p>(i) Sketch on the same set of axes the graphs of the parabola $y = \frac{x^2}{8}$ and the line $y = x - 1$.</p> <p>(ii) Use simultaneous equations to find the points of intersection of the curves.</p>	5

	QUESTION ONE (continued)	Answers	
J	Write $\sqrt{2.36 \times 10^5}$ in scientific notation to two decimal places.	$\sqrt{2.36 \times 10^5} = \sqrt{23.6} \times \sqrt{10^4}$ $= 4.86 \times 10^2$ (correct to 2 dec places)	1
K	Sketch the region where $x^2 + y^2 \leq 16$		2
L	Jim bought two tickets in a raffle where 200 tickets were sold. What is the Probability that he won 1 st , 2 nd and 3 rd prizes.	It would be impossible for him to win 3 prizes because he only bought 2 tickets $\therefore P(E) = 0$.	1
M	Write as a single simplified fraction $\frac{ab}{5} + \frac{a}{10}$	$\frac{2ab + a}{10} = \frac{a(2b+1)}{10}$	1
N	Describe the translation of the circle $x^2 + y^2 = 16$ required to obtain the circle $(x - 4)^2 + (y + 3)^2 = 16$ choosing words from up, down, left or right.	4 to the right. 3 down.	2
O	Find the coordinates of the y-intercept of the parabola $y = x^2 + 3x - 6$	$x=0 \rightarrow$ Intercept of -6.	1
P	Write as a simplified fraction with a rational denominator $\frac{2}{1-\sqrt{5}}$	$\frac{2}{1-\sqrt{5}} \times \frac{1+\sqrt{5}}{1+\sqrt{5}} = \frac{2+2\sqrt{5}}{-4} = -\frac{(1+\sqrt{5})}{2}$	2
Q	Divide \$850 in the ratio 5 : 4 : 1	\$425, \$340, \$85.	1

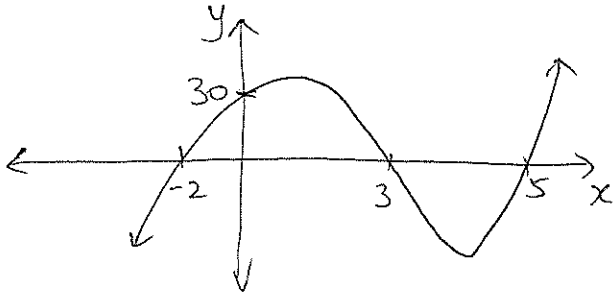
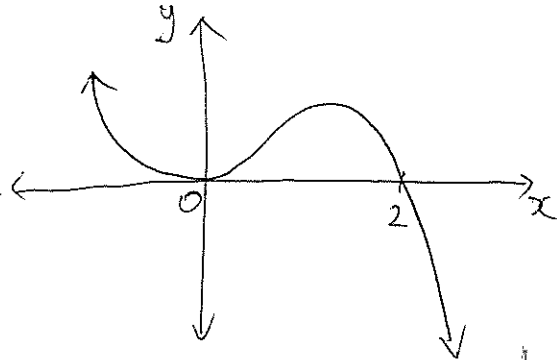
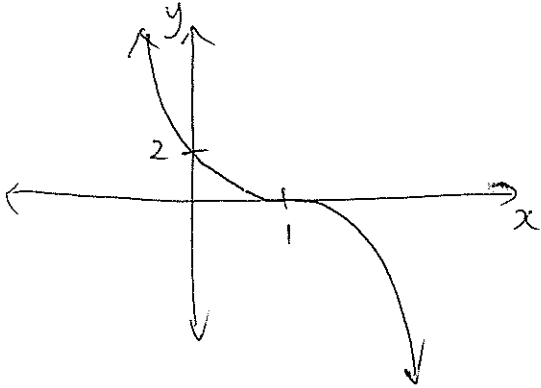
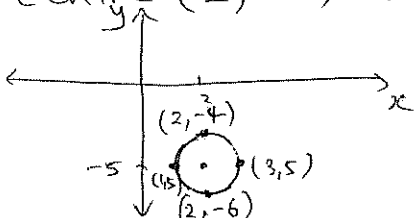
	QUESTION ONE	Answer	
A	Find the volume of a cone with radius 3.5 cm and height 5 cm correct to 2 decimal places.	$V = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}\pi (3.5)^2 \times 5$ $= 64.44 \text{ cm}^3 \text{ (correct to 2 dec. places)}$	1
B	Find the Amount after five years when \$1040 is invested at 6% p.a Compound interest to the nearest dollar.	$A = 1,040 \times (1.06)^5$ $= \$1392 \text{ (to nearest dollars)}$	1
C	Find the value of A if the angle A is in the 2 nd quadrant and $\sin A = \frac{\sqrt{3}}{2}$	$A = (180^\circ - 60^\circ)$ $= 120^\circ$	1
D	Find the size of each angle in a regular decagon	$A = \frac{2 \times 10 \times 180 - 360}{10}$ $= 144^\circ$	1
E	Factorise fully: $16m^2 - 25n^2$	$(4m + 5n)(4m - 5n)$	1
F	For the polynomial below determine the value of P(3). $P(x) = x^3 - 2x^2 + x - 5$	$P(3) = 3^3 - 2 \times 3^2 + 3 - 5$ $= 7$	1
G	Write with positive indices $\frac{x^{-5}y^3}{x^2y^{-4}}$	$\frac{\frac{1}{x^5} y^3}{x^2 \frac{1}{y^4}} = \frac{y^7}{x^7}$	1
H	Write the gradient of the line $3y = -5x + 2$	$m = -\frac{5}{3}$	1
I	Solve $(3x - 5)(x + 4) = 0$	$x = \frac{5}{3} \text{ or } -4.$	1

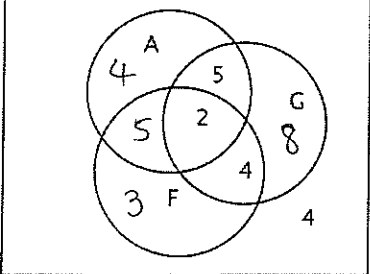
	QUESTION TWO	Answers	
A	$\cos A = \frac{9^2 + 8^2 - 7^2}{2 \times 9 \times 8}$ <p>The cosine rule was used to find the cos of the angle A in a triangle.</p> <p>(a) Find the value of the angle A to the Nearest minute</p> <p>(b) Draw a sketch of the triangle including the above values.</p>	<p>(a) $48^\circ 11'$</p> 	3
B	<p>A set of numbers consists of 12, 1, 18, 19, 16, 10, and 4 and one other. What is the missing number if the median of all the numbers is 13?</p> <p>$1, 4, 10, 12, 16, 18, 19$</p> <p style="margin-left: 100px;">↑</p> <p style="margin-left: 100px;">14</p> <p>→ Med = $\frac{12 + 14}{2}$</p>	<p>14</p>	2
C	<p>Mark bought some toys in bulk for \$x each. He sold them for \$119 each, making a profit of x%.</p> <p>(i) Write a quadratic equation using this information.</p> <p>(ii) Solve the equation to find the value of x</p>	$x(1 + \frac{x}{100}) = 119$ $100x(1 + \frac{x}{100}) = 11900 \quad (3)$ $x(100 + x) = 11900$ $(i) \quad x^2 + 100x - 11900 = 0$ $(ii) \quad x = \frac{-100 \pm \sqrt{(100)^2 + 4 \times 11900}}{2} \quad (2)$ $= \frac{-100 \pm 240}{2}$ $= -50 \pm 120$ $= 70 \text{ or } -170$ <p>∴ $x = 70$ (-170 extraneous)</p>	5

D	<p>(i) Expand and simplify the following polynomial $2x(x^2 - 3x + 2) + 2(x^4 - 5)$</p> <p>and state</p> <p>(ii) The degree (iii) The leading coefficient (iv) The constant term</p>	<p>(i) $2x^3 - 6x^2 + 4x + 2x^4 - 10$ $= 2x^4 + 2x^3 - 6x^2 + 4x - 10$</p> <p>(ii) 4 (iii) 2 (iv) -10</p>	4
E	<p>What values of y satisfy the inequation</p> $48 \leq 3y - 6 \leq 54$	$54 \leq 3y \leq 60$ $18 \leq y \leq 20$	2
F	<p>A car depreciates at 24% in the first year and 10% p.a. after that. At the end of the third year it is worth \$12312. Find its original value.</p>	$\$12312 \times \left(\frac{100}{90}\right)^2 \times \frac{100}{76} = \cancel{\$12312} = \$20000$	2

$$50 \left(1 + \frac{25}{100}\right)$$

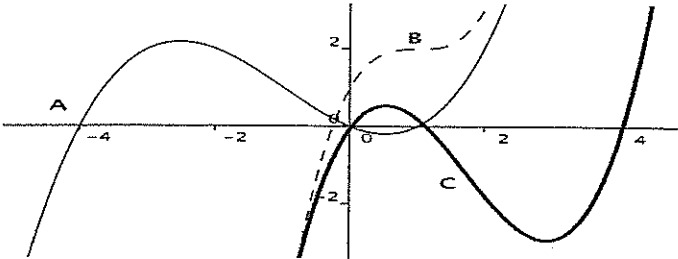
QUESTION THREE

<p>A Sketch the following functions marking all intercepts</p> <p>(i) $y = (x - 3)(x + 2)(x - 5)$</p> <p>(ii) $y = -2x^2(x - 2)$</p> <p>(iii) $y = -2(x - 1)^3$</p>	<p style="text-align: right;">6</p>   
<p>B By first finding the centre and radius, sketch the circle $x^2 + y^2 - 4x + 10y + 28 = 0$</p>	<p style="text-align: right;">3</p> $x^2 - 4x + y^2 + 10y + 28 = 0$ $x^2 - 4x + (-2)^2 + y^2 + 10y + 5^2 = -28 + 4 + 25$ $(x-2)^2 + (y+5)^2 = 1$ <p>Centre $(2, -5)$ Radius = 1</p> 

C	Write a polynomial of degree 4 with a leading coefficient of -3 and a constant term of 9.	$-3x^4 + 9$	2
D	Find the coefficient of x^2 in the expansion of $(x + 2)(x^2 + 3x + 8)$	$x^3 + 3x^2 + 8x + 2x^2 + 6x + 16$ $= x^3 + 5x^2 + 14x + 16$ <p>\therefore <u>5</u> is the coefficient of x^2</p>	2
E	For what value of k is $(x-2)$ a factor of $x^3 - (k + 3)x^2 + kx + 6$	$2^3 - (k+3)(2)^2 + 2k + 6 = 0$ $8 - 4k - 12 + 2k + 6 = 0$ $2 - 2k = 0$ $\boxed{k=1}$	2
F		<p>Alex is an actor who enjoys golf. He has 35 friends. Some are actors, some play golf and some are female. Two are all three and four fit into none of these categories. Five are male actors who play golf. Four are female golfers who don't act. Seven are female actors. Nineteen of his friends play golf and 16 are actors.</p> <p>(i) Fill in the missing numbers in the diagram.</p> <p>(ii) If a friend is chosen at random what is the probability that he/she is male or plays golf?</p> <p>(ii) $\frac{27}{35}$</p>	3

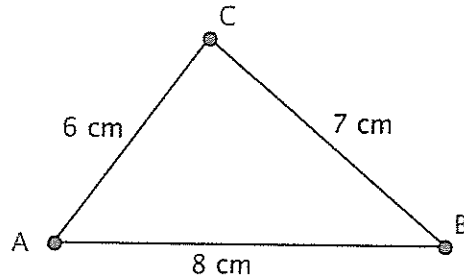
SOLNS

QUESTION FOUR

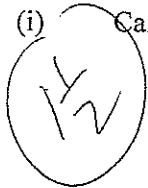
A	<p>Match each curve to one of the following equations. $y = \frac{1}{2}x(x-1)(x-4) = C$ Write the correct letter next to each equation $y = \frac{1}{6}x(x+4)(x-1) = A$ $y = (x-1)^3 + 2 = B$</p> 	3
B	<p>Find the quotient and remainder when the polynomial $3x^4 + 12x^3 + 2x^2 - 16x - 8$ is divided by $x - 3$</p> $ \begin{array}{r} 3x^3 + 21x^2 + 65x + 179 \\ x-3 \overline{) 3x^4 + 12x^3 + 2x^2 - 16x - 8} \\ \underline{3x^4 - 9x^3} \\ 21x^3 + 2x^2 \\ \underline{21x^3 - 63x^2} \\ 65x^2 - 16x \\ \underline{65x^2 - 195x} \\ 179x - 8 \\ \underline{179x - 537} \\ 529 \end{array} $ <p style="margin-left: 100px;"> $Q(x) = 3x^3 + 21x^2 + 65x + 179$ $R(x) = 529$ </p>	4
C	<p>(i) Find $P(3) + Q(2)$</p> $ \begin{aligned} &P(x) = x^3 - 5x + 3 \quad Q(x) = 4x^2 + 2x - 9 \\ &= 3^3 - 5 \times 3 + 3 + 16 + 4 - 9 = 15 + 11 \\ &= 26 \end{aligned} $	2

D

3



- (i) Calculate the size of the angle B correct to the nearest degree.



$$\cos B = \frac{a^2 + b^2 - c^2}{2ab}$$

$$= \frac{49 + 64 - 36}{2 \times 56}$$

$$\Rightarrow \cos B = 0.6875$$

$$B = 46.56$$

$$\underline{B = 47^\circ}$$

- (ii) Using your answer in part (i) or otherwise, calculate the area of $\triangle ABC$ to the nearest cm^2 .



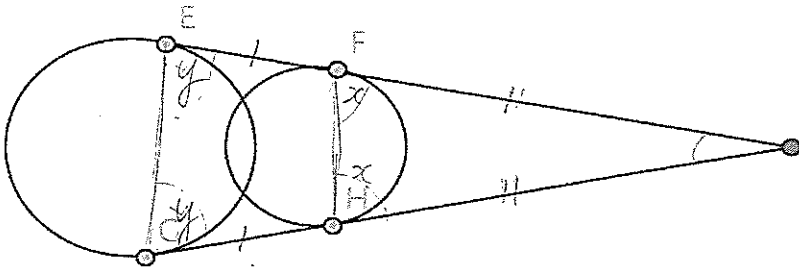
$$A = \frac{1}{2} \times 7 \times 8 \times \sin 47^\circ$$

$$= 20.47$$

$$\underline{= 20 \text{ cm}^2}$$

E

4



EF and GH are common tangents to the two circles above. Show that GEFH is a cyclic quadrilateral

$EI = GI$ (tangents to a circle from a point are equal)
and $FI = HI$ (same reason)

Let $\angle FHI = x$ and $\angle GEF = y$

Then $\angle FHI = x$
and $\angle GFI = y$] base angles of isosceles' Δ 's.

$\therefore \angle GIE = 180 - 2y$
and $\angle HIE = 180 - 2x$] Angle sum of a $\Delta = 180^\circ$

$$\Rightarrow x = y$$

\therefore GEFH is a cyclic quad.
(exterior angle of cyc. quad is equal to opp. interior angle)

QUESTION FIVE

<p>A</p> <p>For the Polynomial $P(x) = x^3 + 2x^2 - 5x - 6$</p> <p>(i) Find one factor using the factor theorem. $P(-1) = -1 + 2(-1)^2 - 5(-1) - 6 = 0 \Rightarrow (x+1)$ is a factor (1) or $(x+3)$ or $(x-2)$</p> <p>(ii) Use long division to find a quadratic factor.</p> <p>(iii) Use factorisation to find the other linear factors.</p> <p>(iv) Sketch $P(x)$, marking the zeros.</p> <p>(i) $x^3 + 2x^2 - 5x - 6$ $\begin{array}{r} x^2 - 5x - 6 \\ x^3 + 2x^2 - 5x - 6 \\ \hline x^3 + 2x^2 - 5x - 6 \\ \hline 0 \end{array}$</p> <p>(ii) $\frac{x^2 - 5x - 6}{x^2 + x} = \frac{-6x - 6}{-6x - 6} = \frac{0}{0}$</p> <p>(iii) $x^2 - 5x + 6 = (x+1)(x-2)(x-3)$ $(x+1)(x+3)(x-2) = P(x)$ (1)</p>	<p>B</p> <p>Below is a sector of a circle with radius 4cm and angle 240°</p> <p>(i) Find the radius of the cone formed by joining the radii of the sector.</p> <p>(ii) Find the outside surface area of the cone in terms of π. (the cone has no base)</p> <p>$C = \frac{240}{360} \times 2 \times \pi \times 4$ $= \frac{16\pi}{3}$ now $2\pi r = \frac{16\pi}{3}$ $r = 2\frac{2}{3} = \frac{8}{3} = 2.6 \text{ cm}$ (2)</p> <p>$SA = \pi r s$ $= \pi \times \frac{8}{3} \times 4 = \frac{32\pi}{3} \text{ cm}^2$ (1)</p>
--	---

<p>C</p> <p>If $x^3 - 5x^2 + 7x - 2 = (x-2)(ax^2 + bx + c)$, find a, b and c</p> <p>$(x-2)(ax^2 + bx + c) = ax^3 + bx^2 + cx - 2ax^2 - 2bx - 2c$ $= ax^3 + (b-2a)x^2 + x(c-2b) - 2c$</p> <p>now $a=1$ $c-2b=7$ $a=1, c=1$ (3) $b-2a=-5$ $-2c=-2$ $b=-3$</p> <p>For the following set of scores, find:</p> <p>(i) the mean $\frac{57}{12} = 4.75$ (1) 1 2 2 4 4 4 4 4 6 8 9 9 (3)</p> <p>(ii) the inter-quartile range $Q_3 - Q_1 = 4 - 3 = 1$ (2)</p>	<p>D</p> <p>E</p> <p>Above are two similar cones used for ice cream. The larger cone is 10.5 cm high. If their heights are in the ratio 7:2</p> <p>(i) find the height of the smaller cone. $\frac{10.5}{h} = \frac{7}{2} \Rightarrow h = 3 \text{ cm}$ (1)</p> <p>(ii) find the ratio of their volumes. $\frac{7^3}{2^3} = \frac{343}{8}$ (1)</p>
--	--

so $ax^2 + bx + c = x^2 - 3x + 1$
 $a=1, b=-3, c=1$

Year 10 2011

1/20

Yearly

QUESTION SIX

A What is the degree of the polynomial $y = (x - 5)(x - 2)^3$ 2
 On expansion $x \times x^3 = x^4$ etc.
 degree 4 ~~(1)~~ (2)

B Find all the solutions of the equation $(x^2 + 2x - 3)^2 + 2(x^2 + 2x - 3) - 3 = 0$ 3
 let $u = x^2 + 2x - 3$, and $x^2 + 2x - 3 = 1$
 $u^2 + 2u - 3 = 0$ $x^2 + 2x - 4 = 0$
 $(u + 3)(u - 1) = 0$ $(x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a})$
 $u = -3, 1$ $x = \frac{-2 \pm \sqrt{4 - 4 \times 1 \times -4}}{2}$
 $\therefore x^2 + 2x - 3 = -3$ $= \frac{-2 \pm \sqrt{20}}{2} = \frac{-2 \pm 2\sqrt{5}}{2}$
 $x^2 + 2x = 0$ $= -1 \pm \sqrt{5}$
 $x(x + 2) = 0$
 $x = 0, x = -2$
 soln are $0, -2, -1 \pm \sqrt{5}$. (3)

C The box and whisker plot below shows the number of minutes patients waited for Dr Lim and Dr Ward. 3

QL = 10 median 40 QU = 70
 Dr Ward

Median 25
 Dr Lim

QL = 5 10 20 30 35 40 50 60 70 QU = 65

Find;

(i) the range of waiting times for Dr Ward $70 - 10 = 60$ (1)

(ii) the inter-quartile range for Dr Lim $35 - 15 = 20$ (1)

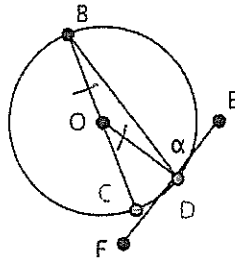
(iii) the median waiting time for Dr Ward. 40 (1)

ABCD E

F G

D

6



The circle above has centre O and diameter BC. FE is a tangent to the circle at the point D. If the angle $BDE = \alpha$, Find in terms of α

- (i) The angle ODB = $(90 - \alpha)^\circ$ (2) $OD \perp FE$
- (ii) The angle OBD = $(90 - \alpha)^\circ$ (2) $\triangle ODB$ is isosceles.
- (iii) The angle COD giving brief reasons for each answer. = $(180 - 2\alpha)^\circ$

angle sum of $\triangle ODB$
straight line angle. (2)

E

Find the values of a and b if $\sqrt{43 - 30\sqrt{2}} = a + b\sqrt{2}$ and a and b are integers.

$$(\sqrt{43 - 30\sqrt{2}})^2 = (a + b\sqrt{2})^2$$

square both sides

$$43 - 30\sqrt{2} = a^2 + 2ab\sqrt{2} + 2b^2$$

$$\text{so } a^2 + 2b^2 = 43 \text{ and } 2ab\sqrt{2} = -30\sqrt{2}$$

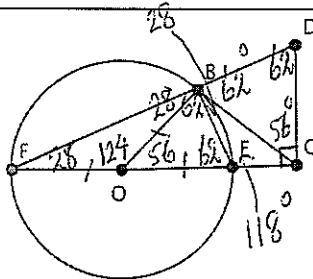
$$\text{Solve sim. } b = \pm 3, a = \pm 5$$

only solution
 $a = 5, b = -3$. (3)

3

F

3



The circle above has centre O and BC is a tangent at B. DC is perpendicular to FC.

If the angle $BDC = 62^\circ$, find the size of the angle CBD showing all working. (No proofs required)

$\hat{C}BD = 62^\circ$
+ some reasoning. (3)

Q7

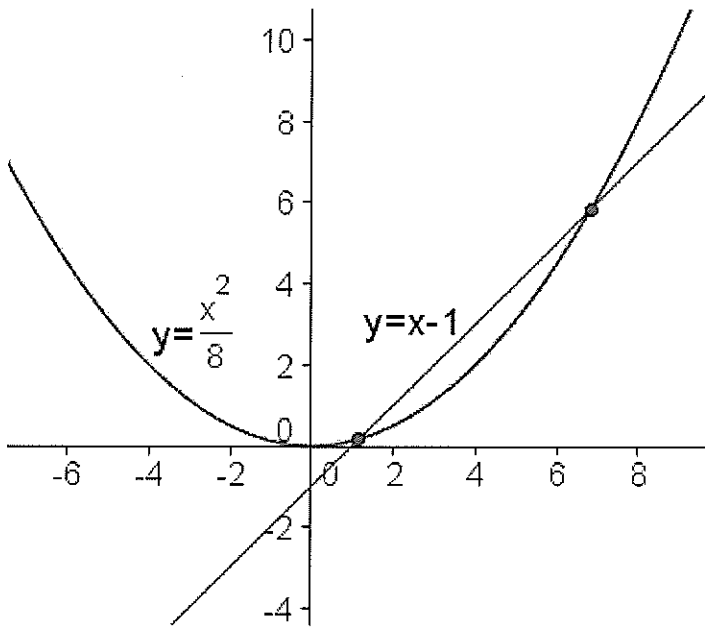
A

0.617% monthly or 7.22% p.a.

\$2511.25 per monthly instalments

B

(i)



(ii)

$$x - 1 = \frac{x^2}{8}$$

$$x^2 - 8x + 8 = 0$$

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

$$(4 + 2\sqrt{2}, 3 + 2\sqrt{2})$$

$$(4 - 2\sqrt{2}, 3 - 2\sqrt{2})$$

C

(a)

$$\begin{aligned}V &= \frac{14^2 \times 16}{3} - \frac{7^2 \times 8}{3} \\&= \frac{2744}{3} \text{cm}^3 \\&= 914.67 \text{cm}^3\end{aligned}$$

(b)

$$\begin{aligned}s &= \sqrt{8^2 + 3.5^2} \\SA &= 7^2 + 14^2 + 4 \times \frac{s}{2}(7 + 14) \\&= 611.75 \text{ cm}^2\end{aligned}$$

D

reflex $\angle BOD = 2\alpha$ (angle at centre twice angle at circumference)

$3\alpha = 360$ (angles at a point O)

$\alpha = 120$

$\angle AOD = 60^\circ$ (supplementary angles)

$\triangle AOD$ is isosceles (equal radii)

$2\gamma + 60 = 180$ (base angles of an isos. triangle, angle sum of a triangle)

$\gamma = 60$

$\angle BOD = 120^\circ$, $\angle OAD = 60^\circ$ & $\angle BCD = 120^\circ$