Student Name: ______________________________

Teacher's Name: ____________________________

KIRRAWEE HIGH SCHOOL

2016

YEAR 12
TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Board-approved calculators may be used
- Write your student name and teacher's name on the front of this examination paper and each answer booklet

Total marks – 100

Section I Pages 3-5

10 marks
- Attempt Questions 1-10
- Allow about 15 minutes for this section

Section II Pages 6-13

90 marks
- Attempt Questions 11-16
- Allow about 2 hours and 45 minutes for this section

MC	Q11	Q12	Q13	Q14	Q15	Q16	TOTAL
/10	/15	/15	/15	/15	/15	/15	/100

Section I
Multiple Choice
10 marks
Answer on the Multiple Choice Answer Sheet provided

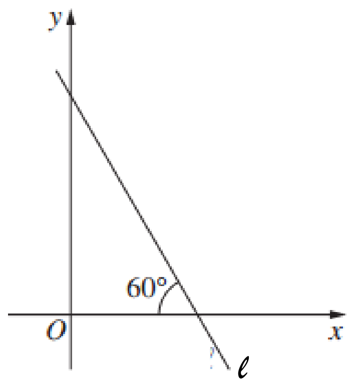
1 What is 4.097 84 correct to three significant figures?

(A) 4.10 (B) 4.09 (C) 4.097 (D) 4.098

2 Which of the following is equal to $\dfrac{1}{2\sqrt{5}-\sqrt{3}}$?

(A) $\dfrac{2\sqrt{5}-\sqrt{3}}{7}$ (B) $\dfrac{2\sqrt{5}+\sqrt{3}}{7}$ (C) $\dfrac{2\sqrt{5}-\sqrt{3}}{17}$ (D) $\dfrac{2\sqrt{5}+\sqrt{3}}{17}$

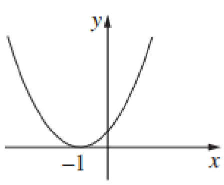
3 The diagram shows the line ℓ.

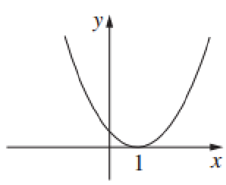


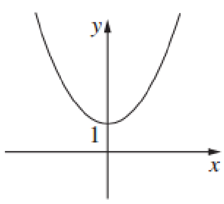
What is the slope of the line l?

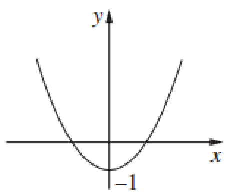
(A) $-\sqrt{3}$ (B) $\sqrt{3}$ (C) $-\dfrac{1}{\sqrt{3}}$ (D) $\dfrac{1}{\sqrt{3}}$

4 Which graph best represents $y=(x-1)^2$?

(A)


(B)


(C)


(D)


5 Using the trapezoidal rule with 4 subintervals, which expression gives the approximate area under the curve $y = xe^x$ between $x = 1$ and $x = 3$?

(A) $\frac{1}{4}\left(e^1 + 6e^{1.5} + 4e^2 + 10e^{2.5} + 3e^3\right)$

(B) $\frac{1}{4}\left(e^1 + 3e^{1.5} + 4e^2 + 5e^{2.5} + 3e^3\right)$

(C) $\frac{1}{2}\left(e^1 + 6e^{1.5} + 4e^2 + 10e^{2.5} + 3e^3\right)$

(D) $\frac{1}{2}\left(e^1 + 3e^{1.5} + 4e^2 + 5e^{2.5} + 3e^3\right)$

6 An infinite geometric series has a first term of 10 and a limiting sum of 12.
What is the common ratio?

(A) $\frac{1}{6}$ (B) $\frac{1}{4}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$

7 A parabola has focus (5,0) and directrix $x = 1$.

What is the equation of the parabola?

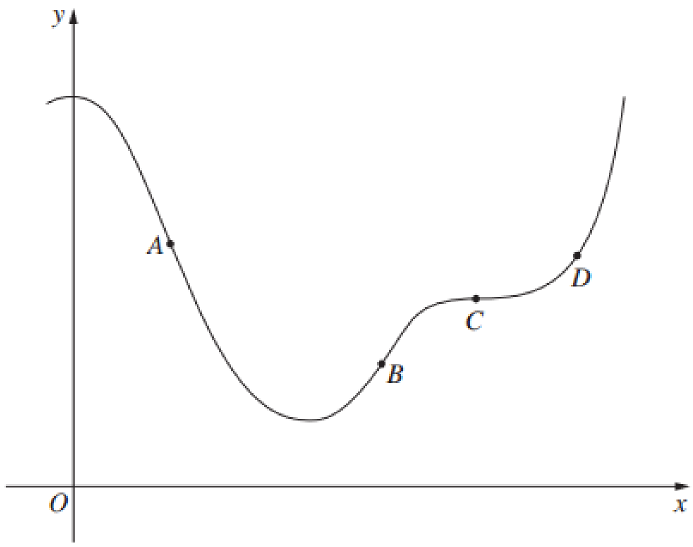
(A) $y^2 = 16(x - 5)$

(B) $y^2 = -16(x - 5)$

(C) $y^2 = 8(x - 3)$

(D) $y^2 = -8(x - 3)$

8 The diagram shows points *A, B, C* and *D* on the graph $y = f(x)$



At which point is $f'(x) > 0$ and $f''(x) = 0$?

(A) *A* (B) *B* (C) *C* (D) *D*

9 What are the solutions of $\sqrt{3}\tan x = -1$ for $0 \le x \le 2\pi$?

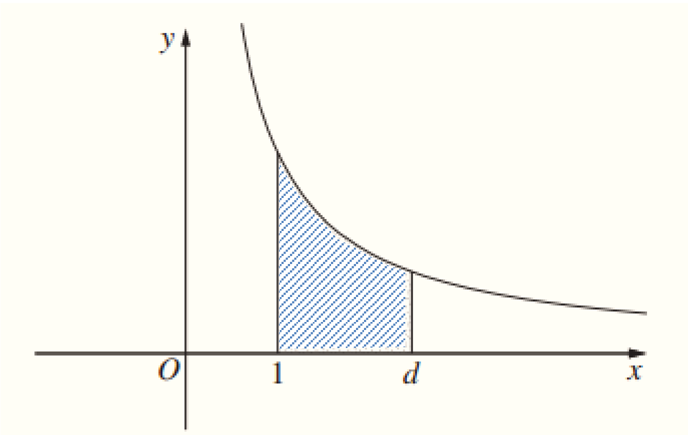
(A) $\frac{2\pi}{3}$ and $\frac{4\pi}{3}$

(B) $\frac{2\pi}{3}$ and $\frac{5\pi}{3}$

(C) $\frac{5\pi}{6}$ and $\frac{7\pi}{6}$

(D) $\frac{5\pi}{6}$ and $\frac{11\pi}{6}$

10 The diagram shows the area under the curve $y = \frac{2}{x}$ from $x = 1$ to $x = d$



What values of d makes the shaded area equal to 2?

(A) e^2 (B) $e+1$ (C) e (D) $2e$

Section II – Full Working Section

90 marks
Attempt Questions 11-16
Allow about 2 hours and 45 minutes for this section

Question 11 (15 marks) **<u>Answer in the separate booklet provided</u>** **Marks**

(a) Solve $|3x-1|<2$ **2**

(b) Factorise $1-x^6$ **2**

(c) Differentiate x^2e^x **2**

(d) Expand and simplify $(\sqrt{3}-1)(2\sqrt{3}+5)$. **2**

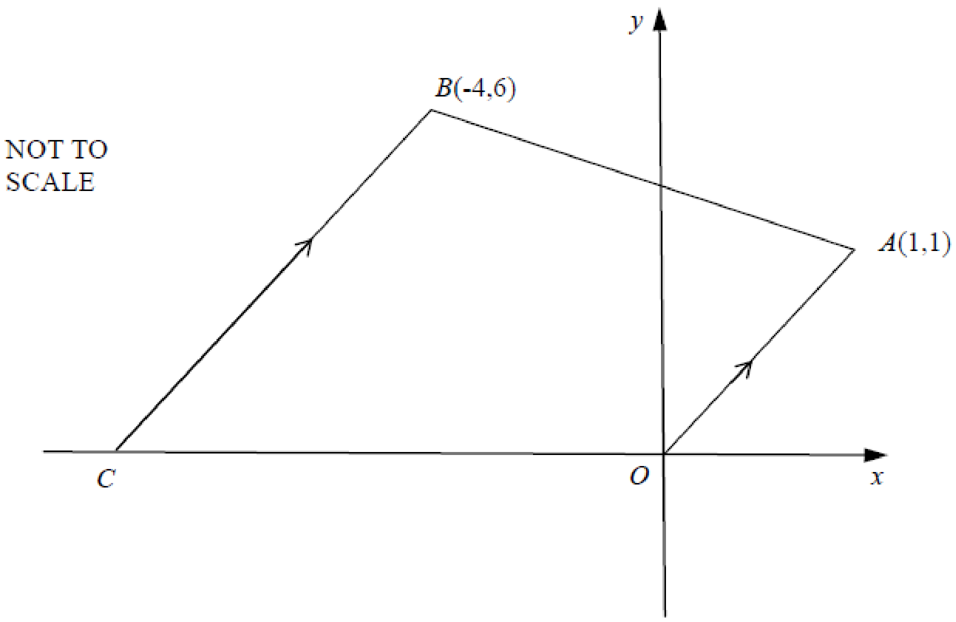
(e) Solve $2^{2x+1}=32$ **2**

(f) Evaluate $\int_0^1 \frac{x^2}{x^3+1}\,dx$ **3**

(g) Evaluate $\int_0^{\frac{\pi}{4}} \cos 2x\,dx$ **2**

Question 12 (15 marks) **Answer in the separate booklet provided** **Marks**

(a)



In the diagram, $OABC$ is a trapezium with $OA \parallel CB$. The coordinates of O, A and B are $(0,0)$, $(1,1)$ and $(-4,6)$ respectively.

(i) Calculate the length OA. **1**

(ii) Write down the gradient of line OA. **1**

(iii) What is the size of $\angle AOC$? **1**

(iv) Find the equation of the line BC, and hence find the coordinates of C. **2**

(v) Show that the perpendicular distance from O to the line BC is $5\sqrt{2}$. **2**

(vi) Hence, or otherwise, calculate the area of the trapezium $OABC$. **2**

(b) Evaluate the arithmetic series $2+5+8+11+\ldots\ldots+1094$ **2**

(c) Find $\int \frac{1}{(1+x)^2}\,dx$ **2**

(d) The lengths of the sides of a triangle are 8 cm, 9 cm and 14 cm. **2**
Find the size of the angle opposite the smallest side, to the nearest degree.

Question 13 (15 marks) <u>Answer in the separate booklet provided</u> **Marks**

(a) (i) Differentiate $3+\sin 2x$ **2**

(ii) Hence, or otherwise, find $\int \frac{\cos 2x}{3+\sin 2x}\,dx$ **2**

(b) A function is defined by $f(x)=x^3-3x^2-9x+10$.

(i) Find the coordinates of the turning points and determine their nature. **3**

(ii) Find the coordinates of the point of inflexion. **2**

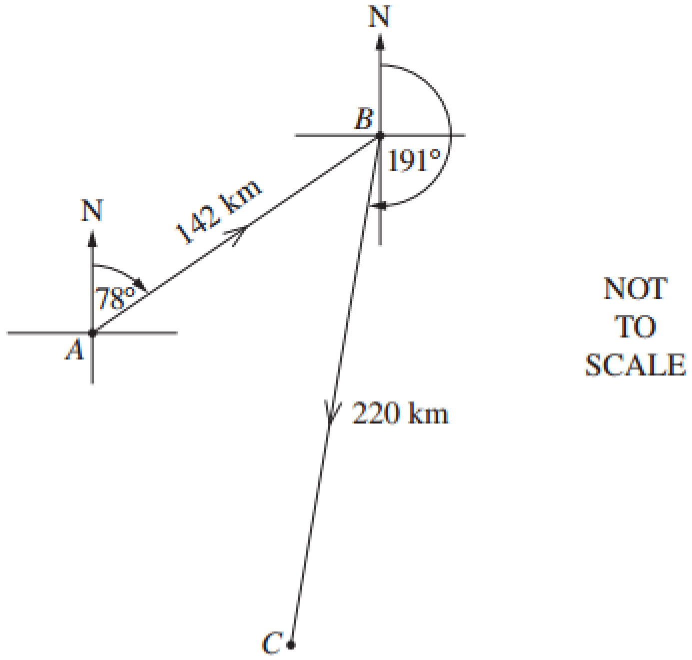
(iii) Sketch the graph for $y=f\left(x\right)$, showing all important information. **2**

(c) Find the solutions of $2\sin x=1$ for $0\le x\le 2\pi$. **2**

(d) The area of a sector of a circle of radius 6 cm is 50 cm^2. **2**
Find the length of the arc of the sector, correct to 2 decimal places.

Question 14 (15 marks) <u>Answer in the separate booklet provided</u> **Marks**

(a) Chris leaves island A in a boat and sails 142 km on a bearing of 078° to island B. Chris then sails on a bearing of 191° for 220 km to island C, as shown in the diagram.
(The diagram has also been replicated in your Question 14 Answer Booklet).



(i) Show that the distance from island C to island A is approximately 210 km. **2**

(ii) Chris wants to sail from island C directly to island A. On what bearing should Chris sail? Give your answer correct to the nearest degree. **3**

(b) The roots of the equation $2x^2 - 5x + 12 = 0$ are α and β.

Find the value of:

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

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

(iii) $\dfrac{1}{\alpha} + \dfrac{1}{\beta}$ **2**

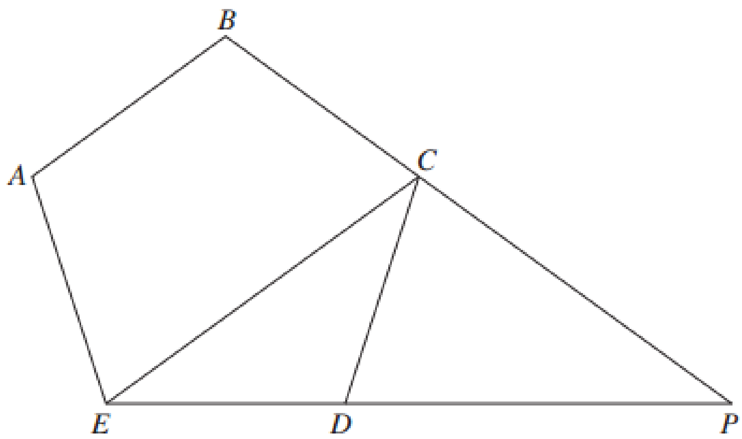
Question 14 (continued) **Marks**

(c) Sienna bought a new car costing \$19 600. The value of the car depreciates by 15% of the new price in its first year and at 12.5% of the previous year's value in each succeeding year. What is the value of the car (to the nearest dollar) after 8 years? **3**

(d) Find the exact volume of the solid formed when the curve $y = \sqrt{x+3}$ is rotated about the x-axis between $x = 1$ and $x = 6$. **3**

Question 15 (15 marks) <u>Answer in the separate booklet provided</u> **Marks**

(a) The diagram shows a regular pentagon $ABCDE$. Sides ED and BC are produced to meet at P.
(This diagram has been replicated in your Question 15 Answer Booklet)



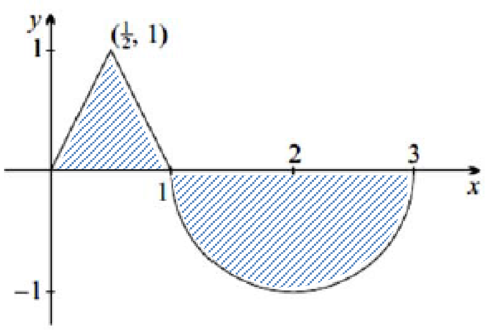
In your answer booklet:

(i) Find the size of $\angle CDE$ **2**

(ii) Hence, show that ΔEPC is isosceles **2**

(b) Find the equation of the locus of the point $P(x, y)$ that moves so that it is equidistant from the point (2, 5) and the line $y = -3$. **2**

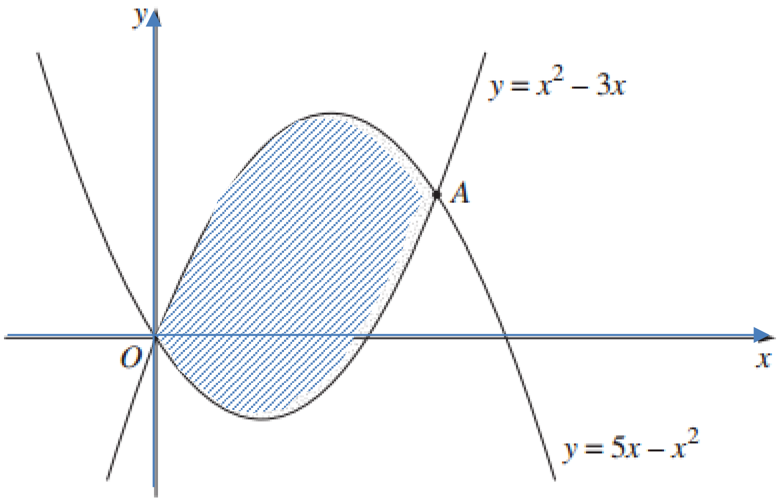
(c)



The diagram above shows the function $y = g(x)$ with domain $0 \le x \le 3$. **2**

The arc is a semi-cricle. Find $\int_0^3 g(x)\,dx$.

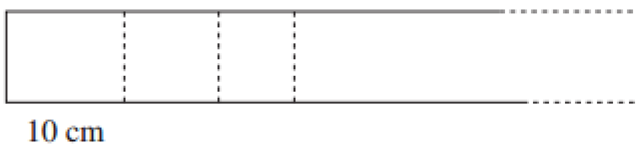
(d) The diagram shows the parabola $y = 5x - x^2$ and $y = x^2 - 3x$. The parabolas intersect at the origin O and point A. The region between the two parabolas is shaded.



(i) Find the x – coordinate of the point A. **1**

(ii) Find the area of the shaded region, correct to 1 decimal place. **3**

(e) Rectangles of the same height are cut from a strip and arranged in a row. The first rectangle has width 10 cm. The width of each subsequent rectangle is 96% of the width of the previous rectangle.



NOT TO SCALE

(i) Find the length of the strip required to make the first ten rectangles. **2**

(ii) Explain why a strip of length 3 m is sufficient to make any number of rectangles. **1**

Question 16 (15 marks) **Answer in the separate booklet provided** **Marks**

(a) The derivative of a function $f(x)$ is $f'(x) = 4x - 3$. The line $y = 5x - 7$ is tangent to the graph of $f(x)$. **3**

Find the function $f(x)$.

(b) The graphs $y = x^2 - 3x - 5$ and $y = x + k$ have only one point of intersection, *P*.

(i) Show that the *x* – coordinate of *P* satisfies $x^2 - 4x - 5 - k = 0$ **1**

(ii) Find the value of *k*. **2**

(iii) Find the coordinates of *P*. **2**

(c) Andrew takes out a loan of $360 000. The loan is to be repaid in equal monthly repayments, $*M*, at the end of each month, over 25 years (300 months). Reducible interest is charged at 6% per annum, calculated monthly.

Let $$A_n$ be the amount owing after the *n*th repayment.

(i) Show that an expression for the amount owing after two months, $$A_2$ is: **2**

$$A_2 = 360\,000(1.005)^2 - M(1 + 1.005)$$

(ii) Show that the monthly repayment is approximately $2319.50. **2**

(d) A soft drink manufacturer wants to minimise the amount of aluminium in its cans while still holding 375 mL of soft drink. Given that 375 mL has a volume of 375 cm^3:

(i) Show that the surface area of a can is given by $S = 2\pi r^2 + \frac{750}{r}$. **1**

(ii) Find the radius of the can that gives the minimum surface area. **2**

End of paper.
Go back and check all of your answers.
Re-enter all of your calculations into your calculator and check that you still get the same answer.

2016 Trial (Mathematics) Solutions

Multiple Choice (1 mark each)

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

Qu.11

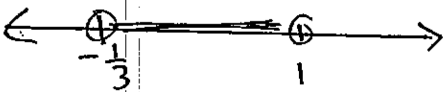
(a) $|3x-1|<2$

make $|3x-1|=2$

$\therefore\ 3x-1=2$ or $3x-1=-2$

$3x=3$ or $3x=-1$

$x=1$ or $-\frac{1}{3}$ $\leftarrow$ (1)



Test $x=0$

$|3\times 0-1|<2$

$|-1|<2$

$1<2$ ✓

$\therefore\ -\frac{1}{3}<x<1$ $\leftarrow$ (1) must have it written as 1 expression

(b) $1-x^6$ $\leftarrow$ (1)

$=(1+x^3)(1-x^3)$

$=(1+x)(1-x+x^2)(1-x)(1+x+x^2)$ $\leftarrow$ (1)

OR $(1-x^2)(1+x^2+x^4)$ $\leftarrow$ (1)

$(1+x)(1-x)(1+x^2+x^4)$ $\leftarrow$ (1)

(c) $y=x^2e^x$

$y'=e^x\times 2x+x^2\times e^x$ $\leftarrow$ (1)

$\left.\begin{array}{l} y'=2xe^x+x^2e^x \\ y'=xe^x(2+x) \end{array}\right\}$ $\leftarrow$ (1)

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

$\left.\begin{array}{l} =\sqrt{3}(2\sqrt{3}+5)-1(2\sqrt{3}+5) \\ =6+5\sqrt{3}-2\sqrt{3}-5 \end{array}\right\}$ $\leftarrow$ (1)

$=1+3\sqrt{3}$ $\leftarrow$ (1)

(e) $2^{2x+1}=32$

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

$2x+1=5$

$2x=4$

$x=2$ $\leftarrow$ (1)

(f) $\int_0^1 \frac{x^2}{x^3+1}\,dx$

$\frac{1}{3}\int_0^1 \frac{3x^2}{x^3+1}\,dx$ $\leftarrow$ (1)

$=\left[\frac{1}{3}\log_e(x^3+1)\right]_0^1$ $\leftarrow$ (1)

$=\frac{1}{3}\log_e 2-\frac{1}{3}\log_e 1$

$=\frac{1}{3}\log_e 2-0$

$=\frac{1}{3}\log_e 2$ $\leftarrow$ (1)

$=0.23104906$

(g) $\int_0^{\frac{\pi}{4}} \cos 2x\,dx$

$=\left[\frac{1}{2}\sin 2x\right]_0^{\frac{\pi}{4}}$ $\leftarrow$ (1)

$=\left(\frac{1}{2}\sin\frac{\pi}{2}\right)-\left(\frac{1}{2}\sin 0\right)$

$=\frac{1}{2}\sin\frac{\pi}{2}$

$=\frac{1}{2}\times 1$

$=\frac{1}{2}$ $\leftarrow$ (1)

Qu. 12

(a) (i) $d=\sqrt{(1-0)^2+(1-0)^2}$

$d=\sqrt{1+1}$

$d=\sqrt{2}$ ⇐ (1)

(ii) $M=\frac{1-0}{1-0}$

$m=1$ ⇐ (1)

(iii) $\tan\theta = m$

$\tan\theta = 1$

$\theta = 45$

$\therefore \angle AOC = 180^\circ - 45^\circ$

$= 135^\circ$ ⇐ (1)

(iv) $m=1$ $B(-4,6)$

$y-6=1(x+4)$

$y-6=x+4$

$x-y+10=0$ ⇐ (1)

For point C, $y=0$

$x-0+10=0$

$x=-10$

$\therefore$ C is $(-10,0)$ ⇐ (1)

(v) $d=\frac{|1\times 0+(-1\times 0)+10|}{\sqrt{1^2+(-1)^2}}$

$d=\frac{|10|}{\sqrt{2}}$ ⇐ (1)

$d=\frac{10}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}$

$d=\frac{10\sqrt{2}}{2}$

$d=5\sqrt{2}$ ⇐ (1)

(vi) $CB=\sqrt{(-4+10)^2+(6-0)^2}$

$=\sqrt{36+36}$

$=\sqrt{72}$

$=6\sqrt{2}$

$A=\frac{h}{2}(x+y)$

$A=\frac{5\sqrt{2}}{2}(6\sqrt{2}+\sqrt{2})$ ⇐ (1)

$A= 30+5$

$A=35$ units^2 ⇐ (1)

(b) $1094=2+(n-1)\times 3$

$1094=2+3n-3$

$1094=3n-1$

$3n=1095$

$n=365$ ⇐ (1)

$\therefore S_{365}=\frac{365}{2}(2+1094)$

$=200020$ ⇐ (1)

(c) $\int \frac{1}{(1+x)^2}\,.dx$

$=\int (1+x)^{-2}\cdot dx$

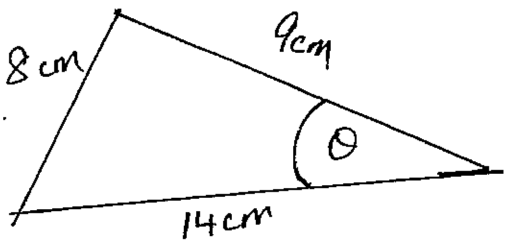
$=\frac{(1+x)^{-1}}{-1\times 1}+C$ ⇐ (1)

$=\frac{(1+x)^{-1}}{-1}+C$

$=-\frac{1}{(x+1)}+C$ ⇐ (1)

* you could use 1 mark for "C"

(d)



$\cos\theta=\frac{14^2+9^2-8^2}{2\times 14\times 9}$ ⇐ (1)

$\cos\theta=\frac{213}{252}$

$\theta=32^0$ ⇐ (1)

Qu-13

(a)(i) $y = 3 + \sin 2x$ 1 for the 2

$y' = 2\cos 2x$ 1 for $\cos 2x$

(ii) $\frac{1}{2}\int \frac{2\cos 2x}{3+\sin 2x} \, dx$ ⇐ (1)

$= \frac{1}{2}\log_e(3+\sin 2x) + C$ ⇐ (1)

(b)(i) $f(x) = x^3 - 3x^2 - 9x + 10$

$f'(x) = 3x^2 - 6x - 9$

make $f'(x) = 0$

$3x^2 - 6x - 9 = 0$

$3(x^2 - 2x - 3) = 0$

$3(x-3)(x+1) = 0$

$x = 3, -1$

when $x = 3$, $y = -17$

when $x = -1$, $y = 15$

$(3, -17)$ and $(-1, 15)$ ⇐ (1)

$f''(x) = 6x - 6$

for $x = 3$

$f''(3) = 6(3) - 6$
$= 12$

since $f''(x) > 0$

$(3, -17)$ is a minimum turning point (concave up) ⇐ (1)

for $x = -1$

$f''(-1) = 6(-1) - 6$
$= -12$

since $f''(x) < 0$

$(-1, 15)$ is a maximum turning point (concave down) ⇐ (1)

(ii) make $f''(x) = 0$

$6x - 6 = 0$

$x = 1$

when $x = 1$, $y = -1$

$\therefore (1, -1)$ ⇐ (1)

test concavity

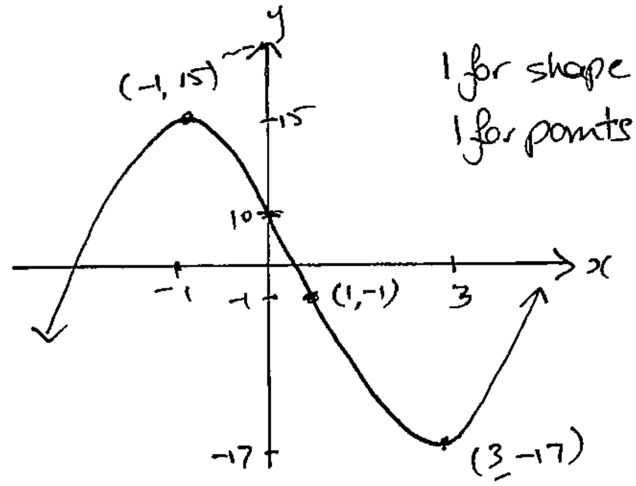
x	0	1	2
$f''(x)$	-6	0	6

when $x = 0$ when $x = 2$ (1)

$f''(0) = -6$ $f''(2) = 6$

$\therefore$ since change in concavity $(1, -1)$ is a point of inflexion

(iii)

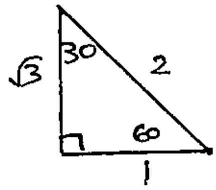


1 for shape
1 for points

(c) $2\sin x = 1$

$\sin x = \frac{1}{2}$

$\sin 30° = \frac{1}{2}$



× S	A ×
T	C

(1)

$x = \frac{30\pi}{180}, \frac{150\pi}{180}$

$x = \frac{\pi}{6}, \frac{5\pi}{6}$ ⇐ (1)

(d) $A = \frac{1}{2}r^2\theta$

$50 = \frac{1}{2} \times 6^2 \times \theta$

$50 = 18 \times \theta$

$\theta = \frac{50}{18}$ ⇐ (1)

$l = r\theta$

$l = 6 \times \frac{50}{18}$

$l = 16.67\text{ cm}$ ⇐ (1)

Qu. 14

(a)(i) $d^2 = 142^2 + 220^2 - 2(142)(220)\cos 67^\circ$ ← (1)

$d^2 = 144151.11909$

$\therefore d \approx 210\text{ km}$ ← (1)

(ii) $\cos C = \dfrac{210^2 + 220^2 - 142^2}{2 \times 210 \times 220}$ ← (1)

$\cos C = \dfrac{72336}{92400}$

$\angle C = 38^\circ$

bearing is $360^\circ - 27^\circ$ ← (1)

$= 333^\circ T$ ← (1)

(b) $2x^2 - 5x + 12 = 0$

(i) $\alpha + \beta = \dfrac{-b}{a}$

$= \dfrac{5}{2}$ ← (1)

(ii) $\alpha\beta = \dfrac{c}{a}$

$= \dfrac{12}{2}$

$= 6$ ← (1)

(iii) $\dfrac{1}{\alpha} + \dfrac{1}{\beta}$

$= \dfrac{\alpha+\beta}{\alpha\beta}$ ← (1)

$= \dfrac{5}{2} \div 6$

$= \dfrac{5}{12}$ ← (1)

(c) 19600×0.85

$= \$16660$ ← (1)

$A = 16660(1 - 0.125)^7$ ← (1)

$A = 16660(0.875)^7$

$A = \$6542.31$ ← (1)

(d) $V = \pi \displaystyle\int_1^6 (\sqrt{x+3})^2 \cdot dx$

$V = \pi \displaystyle\int_1^6 (x+3) \cdot dx$ ← (1)

$V = \pi \left[\dfrac{x^2}{2} + 3x \right]_1^6$ ← (1)

$V = \pi \left[(18+18) - (\tfrac{1}{2}+3) \right]$

$V = \pi \left[36 - 3\tfrac{1}{2} \right]$

$V = \dfrac{65\pi}{2}\text{ units}^3$ ← (1)

Qu.15

(i) Angle size $= \frac{(n-2)\times 180^\circ}{n}$

$\angle CDE = \frac{3\times 180^\circ}{5}$
$= 108^\circ \in (1)$

(ii) $ED = DC$ (equal sides of a regular pentagon)

$\therefore \angle DEC = \angle DCE = 36^\circ$ (base angles of an isosceles triangle)

$\angle BCD = 108^\circ$
$\angle BCE = 72^\circ \ (108^\circ - 36^\circ)$
$\angle DCP = 72^\circ$ (angles on a straight line add to 180°) $\in (1)$

$\angle EDC = \angle DCP + \angle DPC$ (exterior angle theorem of a triangle)

$108 = 72 + \angle DPC$
$\angle DPC = 36^\circ$

$\therefore \angle CED = \angle CPD = 36^\circ$ (base angles of an isosceles triangle)

$\therefore \Delta EPC$ is isosceles $\in (1)$

(b) $PA = PB$

$\sqrt{(x-2)^2+(y-5)^2} = \sqrt{(x-x)^2+(y+3)^2} \in (1)$

$x^2-4x+4+y^2-10y+25 = y^2+6y+9$

$x^2-4x-16y+20=0 \in (1)$

(c) $\int_0^3 g(x)\,.dx$

$= \frac{bh}{2} - \frac{\pi r^2}{2} \in (1)$

$= \frac{1\times 1}{2} - \frac{\pi \times 1^2}{2}$

$= \frac{1}{2} - \frac{\pi}{2} \in (1)$

(d)(i) $x^2-3x = 5x-x^2$
$2x^2-8x=0$
$2x(x-4)=0$
$x=0,\ x=4$
$\therefore$ x coordinate of A is 4 $\in (1)$

(ii) $A = \int_0^4 5x-x^2-(x^2-3x)\,.dx$
$A = \int_0^4 5x-x^2-x^2+3x\,.dx$ $\in (1)$

$A = \int_0^4 8x-2x^2\,.dx$

$A = \left[\frac{8x^2}{2} - \frac{2x^3}{3}\right]_0^4 \in (1)$

$A = \left[4x^2 - \frac{2x^3}{3}\right]_0^4$

$A = (64 - 42\tfrac{2}{3}) - (0)$

$A = 21.3$ units^2 $\in (1)$

(e)(i) $a=10 \quad r=0.96$

$S_{10} = \frac{10(1-0.96^{10})}{1-0.96} \in (1)$

$= \frac{10(1-0.96^{10})}{0.04}$

$= 83.79184$ cm $\in (1)$

(ii) $3m = 300cm$

$S = \frac{a}{1-r}$

$S = \frac{10}{1-0.96}$

$S = \frac{10}{0.04}$

$S = 250 \in (1)$

Since the limiting sum is 250 and less than 300, 3m is sufficient to make any number of rectangles

Qu. 16

1) $f'(x) = 4x - 3$

and $m = 5$

$\therefore 4x - 3 = 5$

$4x = 8$

$x = 2$

when $x = 2$

$y = 5(2) - 7$

$y = 3$

$\therefore (2, 3) \Leftarrow (1)$

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

$f(x) = \frac{4x^2}{2} - 3x + C$

$= 2x^2 - 3x + C \Leftarrow (1)$

sub in $(2, 3)$

$3 = 2(2)^2 - 3(2) + C$

$3 = 8 - 6 + C$

$3 = 2 + C$

$C = 1$

$\therefore f(x) = 2x^2 - 3x + 1 \Leftarrow (1)$

(b)(i) $y = x^2 - 3x - 5$

$y = x + k$

$x^2 - 3x - 5 = x + k$

$x^2 - 4x - 5 - k = 0 \Leftarrow (1)$

(ii) For 1 point of intersection

$\Delta = 0$

$\Delta = b^2 - 4ac$

$(-4)^2 - (4 \times 1 \times [-5 - k]) = 0 \Leftarrow (1)$

$16 - 4(-5 - k) = 0$

$16 + 20 + 4k = 0$

$4k = -36$

$k = -9 \Leftarrow (1)$

(iii) $x^2 - 4x - 5 + 9 = 0$

$x^2 - 4x + 4 = 0$

$(x - 2)(x - 2) = 0$

$\therefore x = 2 \Leftarrow (1)$

when $x = 2$

$y = x + k$

$y = 2 + -9$

$y = -7$

$\therefore$ Pro $(2, -7) \Leftarrow (1)$

(c)(i) $r = \frac{6}{100} \div 12$

$= 0.005$

$A_1 = 360\,000(1.005)^1 - M$

$A_2 = A_1(1.005)^1 - M \Leftarrow (1)$

$A_2 = [360\,000(1.005)^1 - M](1.005)^1 - M$

$A_2 = 360\,000(1.005)^2 - M(1.005)^1 - M$

$A_2 = 360\,000(1.005)^2 - M(1.005 + 1)$

$A_2 = 360\,000(1.005)^2 - M(1 + 1.005) \Leftarrow (1)$

(ii) $A_{300} = 0$ (1)

$A_{300} = 360\,000(1.005)^{300} - M(1 + 1.005 + \dots + 1.005^{299})$

$0 = 360\,000(1.005)^{300} - M(1 + 1.005 + \dots + 1.005^{299})$

$M(1 + 1.005 + \dots + 1.005^{299}) = 360\,000(1.005)^{300}$

$M = 360\,000(1.005)^{300} \div \frac{1(1.005^{300} - 1)}{1.005 - 1}$

$M = 360\,000(1.005)^{300} \times \frac{0.005}{(1.005^{300} - 1)}$

$M = \$2319.485045$

$\therefore M = \$2319.50 \Leftarrow (1)$

(d) $V = \pi r^2 h$ $\qquad S.A = 2\pi r^2 + 2\pi r h$

(i) $375 = \pi r^2 h$

$h = \frac{375}{\pi r^2}$

$S = 2\pi r^2 + 2\pi r \times \frac{375}{\pi r^2}$

$S = 2\pi r^2 + \frac{750}{r} \Leftarrow (1)$

(ii) $S = 2\pi r^2 + 750 r^{-1}$

$S' = 4\pi r - 750 r^{-2}$

$S' = 0$

$4\pi r - \frac{750}{r^2} = 0$

$\frac{4\pi r^3 - 750}{r^2} = 0 \Leftarrow (1)$

$4\pi r^3 = 750$

$r^3 = \frac{750}{4\pi}$

$r = \sqrt[3]{\frac{750}{4\pi}}$

$r = \sqrt[3]{59.68310366}$

$r = 3.907963209 \Leftarrow (1)$