Student Number

Barker College

2023 YEAR 12 ASSESSMENT BLOCK
SEMESTER 1

Mathematics Advanced

Staff Involved: FRIDAY 31 MARCH 2023

- DXC - Mr. Chua
- LMD - Mrs. De Gorter
- JAI - Ms. Iles
- DZB - Mr. Batchen
- LAK - Mrs. Kalnins
- ARM - Mr. Mallam
- RJW - Mr. Williams
- PDJ - Ms. Jouliany
- ARP - Mr. Perkins
- ALY - Mrs. Young

TOPICS COVERED:	
Year 11 Content	Sequences & Series
Series & Finance	Graphs & Equations
Curve Sketching using the Derivative	Integration
Trigonometric functions	

150 copies

General Instructions:

- Write your Student Number at the top of every page
- Working time - 2 hours
- Write using black pen
- Calculators approved by NESA may be used
- A separate reference sheet is provided
- For questions in Section II, show relevant mathematical reasoning and / or calculations

Total marks: 80

Section I - 8 marks (pages 2 - 5)
- Attempt Questions 1 - 8
- Allow about 15 minutes for this section

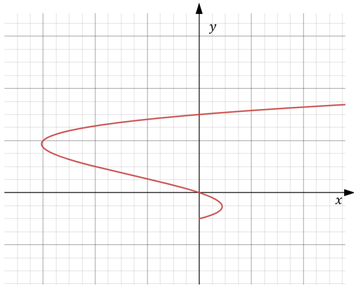
Section II - 72 marks (pages 7 - 27)
- Attempt Questions 9 - 17
- Allow about 1 hour and 45 minutes for this section

Section I

8 marks
Attempt Questions 1 – 8
Allow about 15 minutes for this section

Use the multiple-choice answer sheet for Questions 1 – 8.

1. What type of relation is shown in the graph below?



A. One-to-one

B. One-to-many

C. Many-to-one

D. Many-to-many

2. The wheel below displays the numbers 1-20 exactly once.

If the wheel is spun 160 times, how many times would you expect a number less than 6 to be obtained?

A. 24

B. 32

C. 40

D. 48

3. What is the derivative of $\frac{x}{\cos x}$?

A. $\frac{\cos x + x \sin x}{\cos^2 x}$

B. $\frac{\cos x - x \sin x}{\cos^2 x}$

C. $\frac{x \sin x - \cos x}{\cos^2 x}$

D. $\frac{-x \sin x - \cos x}{\cos^2 x}$

4. A geometric sequence has first term 20 and common ratio -1.5.

What is the value of T_5?

A. 12.5

B. $-151\frac{7}{8}$

C. $101\frac{1}{4}$

D. $-101\frac{1}{4}$

5. A discrete random variable X has the following probability distribution.

x	0	1	2	3
$P(X = x)$	a	$3a$	$5a$	$7a$

Which of the following is $\mathrm{E}(X)$?

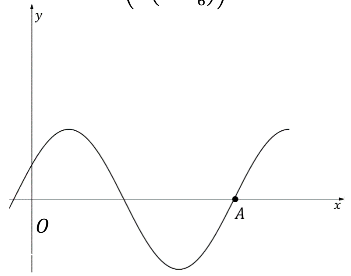
A. $\frac{1}{16}$

B. $\frac{17}{8}$

C. $\frac{35}{16}$

D. 1

6. The graph of $y = \cos\left(2\left(x - \frac{\pi}{6}\right)\right)$ is shown below.



What are the co-ordinates of A?

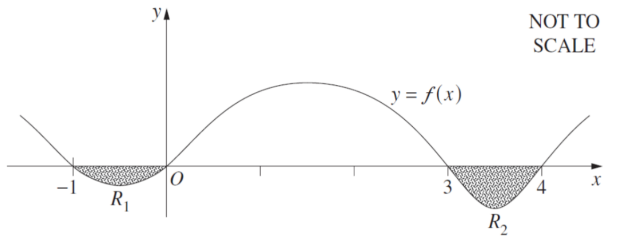
A. $\left(\frac{5\pi}{12}, 0\right)$

B. $\left(\frac{2\pi}{3}, 0\right)$

C. $\left(\frac{11\pi}{12}, 0\right)$

D. $\left(\frac{7\pi}{6}, 0\right)$

7. The diagram shows the graph of $y = f(x)$ with intercepts at $x = -1, 0, 3$ and 4.



The area of the region shaded R_1 is 2 square units.

The area of the region shaded R_2 is 3 square units.

It is given that $\int_0^4 f(x)\,dx = 10$

What is the value of $\int_{-1}^3 f(x)\,dx$

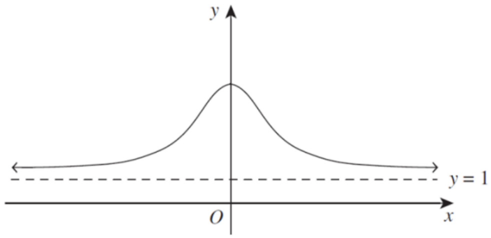
A. 5

B. 9

C. 11

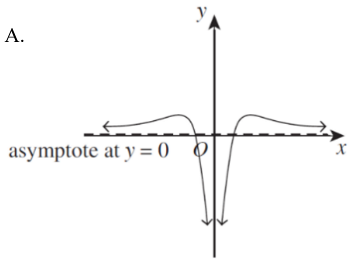
D. 13

8. A sketch of the function $y = f(x)$ is shown below with a horizontal asymptote at $y = 1$.



Which of the following could be the sketch of $y = f'(x)$?

A.



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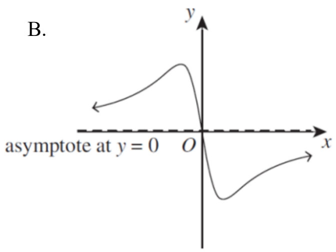
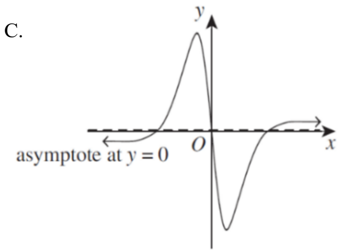
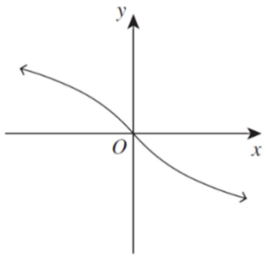


C.



D.



End of Section I

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Student Number

Section II

72 marks
Attempt Questions 9 – 17
Allow about 1 hour and 45 minutes for this section

Answer each question in the appropriate space provided.

In Questions 9 – 17, your responses should include relevant mathematical reasoning and/or calculations.

Question 9 (8 marks**)**

(a) Find the sum of the arithmetic series **3**

$$9 + 16 + 23 + \dots + 2963$$

(b) Differentiate

α. $y = 3 + \sin 2x$ **1**

β. $f(x) = e^x(x^2 + 1)$ **1**

(c) Find the exact gradient of the tangent to the curve $y = x \tan x$ at the point on the curve where $x = \frac{\pi}{3}$. **3**

Student Number

Question 10 (9 marks**)**

(a) Find the following:

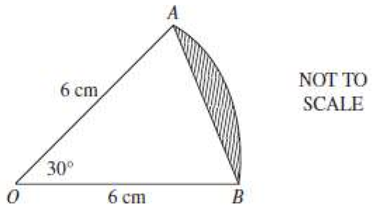
α. $\int \frac{x^2 + 2x}{x}\, dx.$ **1**

β. $\int (3x - 4)^8\, dx.$ **1**

(b) (i) Sketch the function $y = \sqrt{4 - (x-2)^2}$, clearly showing any x-intercepts. **3**

(ii) Hence, exactly evaluate $\int_2^4 \sqrt{4 - (x - 2)^2}\, dx$. **1**

(c) In the diagram OAB is a sector with center O and radius 6cm with $\angle AOB = 30°$.



(i) Find the area of the **triangle** OAB. **1**

(ii) Find the exact value of the area of the shaded **segment**. **2**

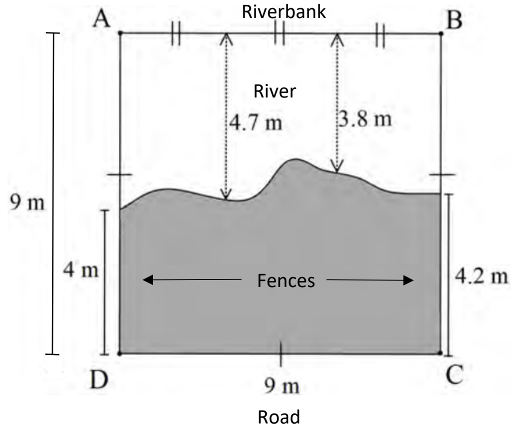
Student Number

Question 11 (8 marks**)**

(a) The diagram is a scale drawing of a paddock (shaded area) bounded by a river, a road and two fences perpendicular to the road. **3**

A farmer wishes to calculate the area of the paddock and has measured the width of the river between the paddock and the riverbank in two spots.

Estimate the area of the paddock using the Trapezoidal rule with four function values.



(b) (i) Find $\frac{d}{dx}(\cos^5 x)$ **1**

(ii) Hence, or otherwise, find $\int \sin x \cos^4 x \, dx$ **2**

(c) The curve $y = f(x)$ passes through the point $(-1,2)$ and has $f'(x) = 4x^3 - 3$. **2**

Find $f(x)$.

Student Number

Question 12 (9 marks**)**

(a) Given that $f(x) = 3x - 1$ and $g(x) = \frac{1}{2x}$ find:

(i) $g(f(x))$ **1**

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(ii) The domain of $g(f(x))$ **1**

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(b) For what values of x is $f(x) = x^2 - 4x^3$ increasing? **3**

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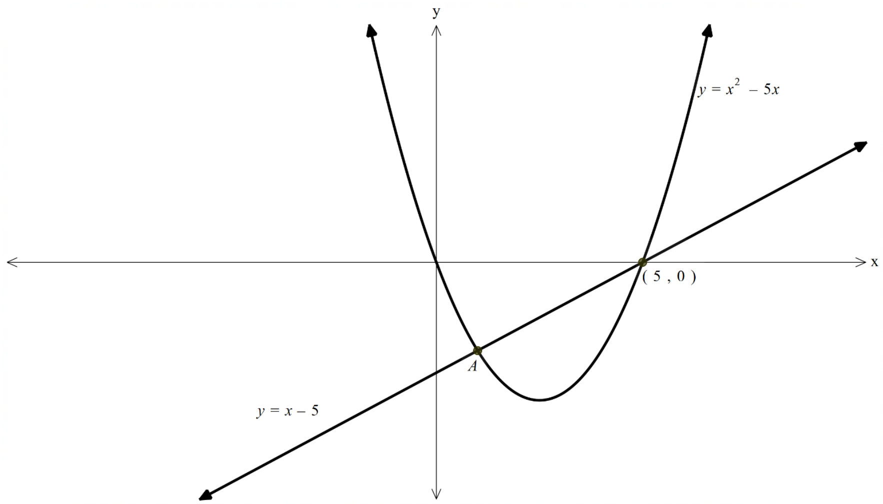
(c) The graphs of $y = x - 5$ and $y = x^2 - 5x$ intersect at the points $(5,0)$ and A, as shown in the diagram.



Find the area between the line $y = x - 5$ and the curve $y = x^2 - 5x$. **4**

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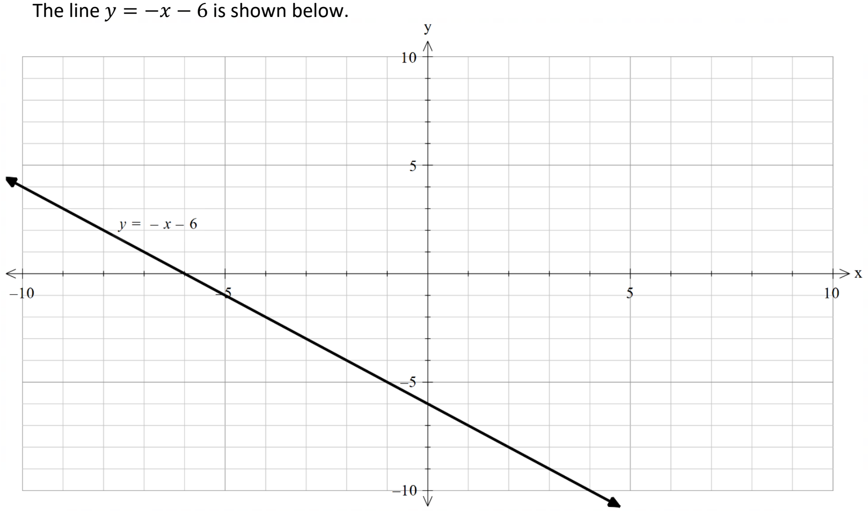
Question 13 (9 marks**)**

(a) The curve $f(x) = x^2(x-4)$ and the line $y = -x - 6$ intersect at the points $(-1, -5)$, $(2, -8)$ and $(3, -9)$.

The line $y = -x - 6$ is shown below.



(i) Sketch the curve $f(x) = x^2(x-4)$ on the graph above, showing the x and y intercepts, and the points of intersections with the line. **2**

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(ii) Hence, solve $f(x) \leq -x - 6$, giving your answer in bracket interval notation. **2**

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(b) Gracie plays football, a sport where a team can win, lose or draw.

Gracie is prone to injury and plays in 80% of her team's games.

When she plays, her team has a 73% chance of winning and a 7% chance of losing.

When she doesn't play her team has a 55% chance of winning and a 20% chance of losing.

(i) By using a tree diagram, or otherwise, show that the probability that Gracie's team wins any given game is 69.4%. **2**

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(ii) Given that Gracie's team doesn't lose in a particular match, what is the probability that Gracie played in that match? **3**

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Student Number

Question 14 (8 marks**)**

(a) The function $y = g(x)$ is transformed to the function $y = \frac{1}{2}g\big(3(x-1)\big) + 4$.

Find the point $P(x, y)$ on $y = g(x)$, if it's image point on the **transformed** function is $P'(-6,5)$. **3**

(b) Indie gets daily injections of a medicinal drug at the same time every day.

She gets d mg of the drug in each injection.

Each day the amount of the drug left in Indie's body from an injection decreases by 15%.

(i) Show that the total amount of the drug (in mg) in Indie's body immediately after the n^{th} injection is given by: **3**

$$A_n = \frac{20d(1 - 0.85^n)}{3}$$

(ii) Hence, find the amount of the drug, d, in one of Indie's daily injections, correct to the nearest mg, if immediately after the 7^{th} injection, there are 50 mg of the drug in Indie's body. **2**

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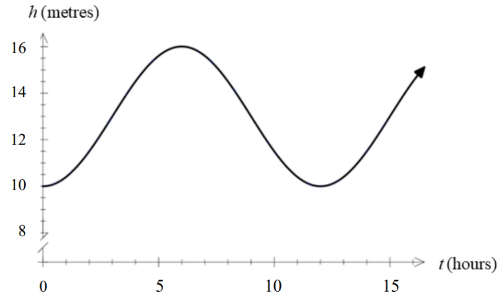
Question 15 (8 marks**)**

(a) The rise and fall in sea level in Jervis Bay due to tides can be modelled by the cosine function: $h = A\cos(bt) + 13$, where h is the depth of the water in metres and t is hours since 8am.



At 8am it is low tide, and the bay is 10 m deep. At the next high tide at 2pm, the bay is 16m deep.

(i) Find the values of A and b. **3**

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(ii) A ship needs 11.5 m of water to sail and only sails in daylight.

Between exactly what times on the first day can the ship sail? **2**

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(b) The sum of the first 10 terms of the following series is -110: **3**

$$\log_2\left(\frac{1}{x}\right) + \log_2\left(\frac{1}{x^2}\right) + \log_2\left(\frac{1}{x^3}\right) + \ldots$$

Find the value of x.

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QUESTION 16 BLANK PAGE

Question 16 (6 marks**)**

Eoghan borrows $650 000 to buy a unit at 6% per annum with interest compounded monthly.
The loan is to be repaid with equal monthly repayments of $4200.
Let $\$A_n$ be the amount owing immediately after the n^{th} monthly payment.

(i) Show that $A_n = 840\ 000 - 190\ 000 \times 1.005^n$ **3**

Question 16 continues on page 23

Student Number

Question 16 continued

(ii) After 15 years, the amount owing is \$373 722 to the nearest dollar. **3**

At this time Eoghan borrows a further \$200 000 to build an extension. He adds this onto his previous mortgage.

If the monthly repayments remain the same, what is the minimum remaining number of months it will take him to pay off the balance of the loan?

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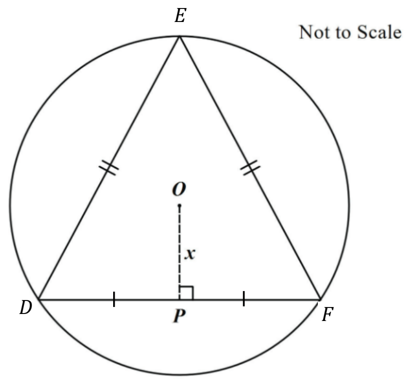
QUESTION 17 BLANK PAGE

Question 17 (7 marks)

An isosceles triangle DEF, where $DE = EF$, is inscribed in a circle of radius 10 cm.
$OP = x$ and OP bisects DF, such that $DF \perp OP$.



(i) Show that the area, A, of $\triangle DEF$ is given by $A = (10 + x)\sqrt{100 - x^2}$. **2**

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Question 17 continues on page 27

Student Number

Question 17 continued

By first showing that the derivative is: **5**

$$\frac{dA}{dx} = \frac{100-10x-2x^2}{\sqrt{100-x^2}}$$

prove that the triangle with maximum area is equilateral.

End of Paper

SECTION I : MULTI-CHOICE

1. ONE INPUT, MANY OUTPUTS. $\boxed{B}$
2. $\frac{5}{20} \times 160 = 40$. $\boxed{C}$
3. USE QUOTIENT RULE. $\boxed{A}$
4. $T_5 = 20 \times (-1.5)^4$
   $= 101\frac{1}{4}$. $\boxed{C}$
5. $a + 3a + 5a + 7a = 1$
   $16a = 1 \quad \therefore a = \frac{1}{16}$
   USING THIS, FIND $E(x) = \frac{17}{8}$ $\boxed{B}$
6. SOLVE $0 = \cos\left(2\left(x - \frac{\pi}{6}\right)\right)$
   $x = \frac{11\pi}{12}$. (YOU CAN SUB IN EA. ANSWER) $\boxed{C}$
7. $\int_0^4 f(x)\,dx = 10$
   $= \int_0^3 f(x)\,dx + R_2 = 10$
   $= \int_0^3 f(x)\,dx - 3 = 10$
   $\therefore \int_0^3 f(x)\,dx = 13$.
   $\int_{-1}^3 f(x)\,dx = R_1 + \int_0^3 f(x)\,dx$
   $= -2 + 13$
   $= 11$ $\boxed{C}$
8. STAT. PT AT $x = 0$.
   INCREASING FOR $x < 0$.
   DECREASING FOR $x > 0$.
   APPROACHING ASYMPTOTE AS
   $x \to -\infty$ & $x \to \infty$. $\boxed{B}$

SECTION II: EXT. RESPONSE

9a. $\left.\begin{aligned} a &= 9 \\ d &= 7 \end{aligned}\right\}$ $2963 = 9 + (n-1) \times 7$
$2963 = 2 + 7n$
$2961 = 7n$
$n = 423$

$S_{423} = \frac{423}{2}\left(2 \times 9 + (422 \times 7)\right)$

$= 628\,578$.

bα. $y' = 2\cos 2x$

β. $u = e^x \quad v = x^2 + 1$
$u' = e^x \quad v' = 2x$
$f'(x) = e^x(x^2+1) + 2xe^x$
$= e^x(x^2 + 2x + 1)$

c. $u = x \quad v = \tan x$
$u' = 1 \quad v' = \sec^2 x$
$y' = \tan x + x\sec^2 x$

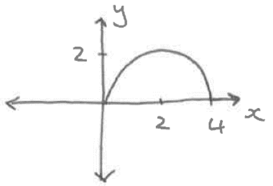
$x = \frac{\pi}{3}$ $\quad y' = \tan\left(\frac{\pi}{3}\right) + \frac{\pi}{3}\sec^2\left(\frac{\pi}{3}\right)$
$= \sqrt{3} + \frac{\pi}{3} \cdot \frac{1}{\cos^2\left(\frac{\pi}{3}\right)}$

$= \sqrt{3} + \frac{4\pi}{3}$

10a. α. $\int \frac{x^2 + 2x}{x}\,dx = \int \frac{x^2}{x} + \frac{2x}{x}\,dx$
$= \int x + 2\,dx$
$= \frac{x^2}{2} + 2x + C$

8. $\int (3x-4)^8\,dx = \frac{(3x-4)^9}{27} + c.$

bi.



· UPPER SEMI-CIRCLE, SHIFTED RIGHT 2 UNITS, RADIUS 2 UNITS.

ii. $\int_2^4 \sqrt{4-(x-2)^2}\,dx$ = AREA OF $\frac{1}{4}$ OF CIRCLE.

$\therefore$ AREA $= \frac{1}{4} \times \pi \times 2^2$

$= \pi$ UNITS^2

ci. AREA $= \frac{1}{2} ab \sin C$

$= \frac{1}{2} \times 6 \times 6 \sin 30^\circ$

$= 9\text{ cm}^2$

ii. SECTOR $= \frac{1}{12} \times \pi \times 6^2$

$= 3\pi\text{ cm}^2$

SHADED SEGMENT

$= 3\pi - 9\text{ cm}^2.$

11a. $9-4.7 = 4.3$, $9-3.8 = 5.2$

$A = \frac{3}{2}\left(4 + 4.2 + 2(4.3+5.2)\right)$

$= 40.8\text{ m}^2$

· IT'S EASIER TO FIND LENGTHS ON LAND FIRST.

bi. $\frac{d}{dx}(\cos x)^5$

$= 5.(-\sin x)(\cos x)^4$

$= -5\sin x \cos^4 x$

ii. $\int \sin x \cos^4 x\,dx$

$= -\frac{1}{5}\int -5\sin x\cos^4 x\,dx$

$= -\frac{1}{5}(\cos^5 x) + C$

c. $f'(x) = 4x^3 - 3$

$f(x) = x^4 - 3x + C$

$f(-1) = (-1)^4 + 3 + C = 2$

$4 + C = 2$

$C = -2$

$\therefore f(x) = x^4 - 3x - 2$

12ai. $f(x) = 3x - 1$, $g(x) = \frac{1}{2x}$

$g(f(x)) = \frac{1}{2(3x-1)}$

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

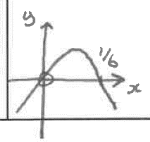
ii. $D: x \in \mathbb{R},\ x \neq 2/6$

"ALL REAL x" SO $\neq \frac{1}{0}$ ☺

iii. $f'(x) = 2x - 12x^2$

INCREASING: $2x - 12x^2 > 0$

$2x(1-6x) > 0$



$\therefore 0 < x < 1/6$

· PART OF GRAPH ABOVE x-AXIS.

c. PT. OF INTERSECTION . . .

$x - 5 = x^2 - 5x$

$0 = x^2 - 6x + 5$

$0 = (x-5)(x-1)$

$x = 5, 1$

AREA $= \int_1^5 (x-5) - (x^2 - 5x)\,dx$

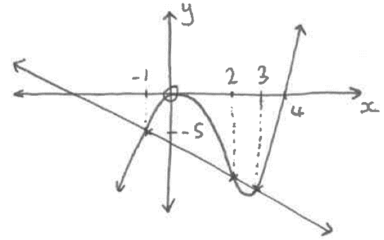
$= \int_1^5 -x^2 + 6x - 5\,dx$

$= \left[\frac{-x^3}{3} + 3x^2 - 5x\right]_1^5$

$= \left(-\frac{125}{3} + 75 - 25\right) - \left(-\frac{1}{3} + 3 - 5\right)$

$= \frac{32}{3}$ UNITS^2

13ai.



$f(x) = x^2(x-4)$

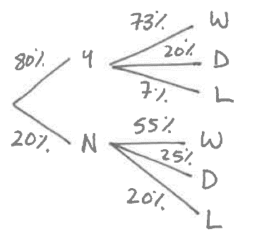
· x-INTS: 0, 4

· CUBIC: BOUNCE, CUT

· y-INT: 0

ii. $(-\infty, -1] \cup [2, 3]$

bi.



$P(\text{PLAY, WIN}) = 80\% \times 73\%$

$= 58.4\%$

$P(\overline{\text{PLAY}}, \text{WIN}) = 20\% \times 55\%$

$= 11\%$

$P(\text{WIN}) = 58.4\% + 11\%$

$= 69.4\%$

ii. CONDITIONAL PROBABILITY:

$P(\overline{\text{LOSES}}) = 1 - P(\text{LOSES})$

$P(W, D)$

$= 1 - (80\% \times 7\% + 20\% \times 20\%)$

$= 1 - 9.6\% = 90.4\%$

$P(\text{PLAYS} \cap \overline{\text{LOSES}}) = 58.4\% + (80\% \times 20\%)$

$= 74.4\%$

PUTTING IT TOGETHER:

$P(\text{PLAYS} \mid \overline{\text{LOSES}})$

$= \frac{P(\text{PLAYS} \cap \overline{\text{LOSES}})}{P(\overline{\text{LOSES}})}$

$= \frac{74.4\%}{90.4\%} = 82.3\%$

14a. $P(x,y)$: · DILATE $\frac{1}{3}$ HORIZ.
· TRANSL. +1 HORIZ.
· DILATE $\frac{1}{2}$ VERT.
· TRANSL. +4 VERT.

$\downarrow$

$P'(x,y)$

· TO GET TO ORIGINAL, REVERSE THE OPERATIONS:

$P'(x,y)$: $(-6,5) \xrightarrow{-4\text{ V.}} (-6,1) \xrightarrow{\times 2\text{ V.}} (-6,2) \xrightarrow{-1\text{ H.}} (-7,2) \xrightarrow{\times 3\text{ H.}} (-21,2)$ $P(x,y)$

OR

SUB. $P'(-6,5)$ INTO TRANSFORMED FUNCTION:

$5 = \frac{1}{2} g(3(-6-1)) + 4$

$1 = \frac{1}{2} g(3(-7))$

$2 = g(-21)$

$\therefore x = -21,\ y = 2.$

bi. $T_1 = d$

$T_2 = 0.85d + d$

$T_3 = 0.85(0.85d + d) + d$

$= 0.85^2 d + 0.85d + d$

$T_n = 0.85^{n-1} d + \ldots + 0.85d + d$

THIS IS A GP WITH:

$a = d$, $r = 0.85$ $\quad S_n = \frac{d(1-0.85^n)}{1-0.85}$

$= \frac{d(1-0.85^n)}{0.15}$

$= \frac{20d(1-0.85^n)}{3}$

ii. $T_7 = \frac{20d(1-0.85^7)}{3} = 50$

$d \times 4.529\ldots = 50$

$d = 11.038\ldots$

$= 11$ mg.

15ai AMPLITUDE: $(16-10) \div 2 = 3$

PERIOD: $\frac{2\pi}{b} = 12$ $\quad \therefore -3$ FOR FLIPPED COS.

IT'S COS GRAPH $\quad$ FROM GRAPH

$b = \pi/6$

ii. EQ'N: $h = -3\cos(\pi/6\, t) + 13$

$11.5 = -3\cos(\pi/6\, t) + 13$

$-1.5 = -3\cos(\pi/6\, t)$

$0.5 = \cos(\pi/6\, t)$

$\therefore \cos\phi = 0.5$

Q1: $\phi = \pi/3$

$t = \pi/3 \div \pi/6 = 2$

Q4: $\phi = 5\pi/3$

$t = 5\pi/3 \div \pi/6 = 10$

8AM + 2 = 10AM

8AM + 10 = 6PM

OR

READ OFF THE GRAPH! ☹

CONT'D ↗

b. REWRITING:

$-\log_2 x - 2\log_2 x - 3\log_2 x + \ldots = -110$

· THIS IS AN AP WITH:

$a = -\log_2 x$, $n = 10$, $l = -10\log_2 x$

$S_{10} = \frac{10}{2}(-\log_2 x - 10\log_2 x)$

$-110 = 5(-11\log_2 x)$

$-110 = -55\log_2 x$

$2 = \log_2 x$

$\therefore x = 4.$

16i. $A_1 = 650\,000 \times 1.005 - 4200$

$A_2 = (650\,000 \times 1.005 - 4200) \times 1.005 - 4200$

$= 650\,000 \times 1.005^2 - 4200 \times 1.005 - 4200$

$= 650\,000 \times 1.005^2 - 4200(1.005 + 1)$

$A_3 = [650\,000 \times 1.005^2 - 4200(1.005+1)] \times 1.005 - 4200$

$= 650\,000 \times 1.005^3 - 4200(1.005^2 + 1.005 + 1)$

· YOU NEED TO SHOW MORE WORKING

$A_n = 650\,000 \times 1.005^n - 4200(\underbrace{1.005^{n-1} + \ldots + 1}_{GP})$

$a = 1$, $r = 1.005$ $\quad S_n = \frac{1(1.005^n - 1)}{0.005}$

$= 200(1.005^n - 1)$

$\therefore A_n = 650\,000 \times 1.005^n - 4200 \times 200(1.005^n - 1)$

CONT'D ↗

$= 650\,000 \times 1.005^n - 840\,000(1.005^n - 1)$

$= -190\,000 \times 1.005^n + 840\,000$

· EXPAND & GROUP LIKE TERMS. LOOK

ii. A_n = AMT OWING $\times 1.005^n - 840\,000(1.005^n - 1)$

· USING EQUATION FROM ABOVE.

· NOW, AMT OWING IS:

\$373 722 + 200 000

= \$573 722

$\therefore 0 = 573\,722 \times 1.005^n - 840\,000(1.005^n - 1)$

NOTHING OWING AT END.

$0 = 840\,000 - 266\,278 \times 1.005^n$

$\frac{-840\,000}{-266\,278} = 1.005^n$

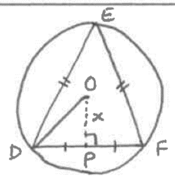
$3.154\ldots = 1.005^n$

$n = \frac{\log_e 3.154\ldots}{\log_e 1.005}$

$= 230.3$

$= 231$ MONTHS.

17i.



AREA $= \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times DF \times (10 + x)$ ..RADIUS=10

$= DP \times (10 + x)$

$OD = 10$ cm (RADIUS)

$DP^2 = 10^2 - x^2$

$DP = \sqrt{100 - x^2}$

FINDING DP USING PYTHAG

$\therefore$ AREA $= \sqrt{100 - x^2} \times (10 + x)$

ii. $A = (10+x)\sqrt{100-x^2}$

$u = 10+x \qquad v = (100-x^2)^{1/2}$

$u' = 1 \qquad v' = -x\,(100-x^2)^{-1/2}$

$$= \frac{-x}{\sqrt{100-x^2}}$$

$$\therefore \frac{dA}{dx} = \sqrt{100-x^2} - \frac{x(10+x)}{\sqrt{100-x^2}}$$

$$= \frac{100-x^2}{\sqrt{100-x^2}} - \frac{x(10+x)}{\sqrt{100-x^2}}$$

$$= \frac{100-x^2-10x-x^2}{\sqrt{100-x^2}}$$

$$= \frac{100-10x-2x^2}{\sqrt{100-x^2}}$$

STAT. PTS WHEN: $100-10x-2x^2=0$

$-2(x^2+5x-50)=0$

$-2(x+10)(x-5)=0$

$\therefore x = \cancel{-10},\ 5$

DENOM $=0$

· TEST IF $x=5$ PRODUCES MAX.

· USE 1ST DERIV. TEST:

x	4	5	6
$\frac{dA}{dx}$	$\frac{28}{\sqrt{84}}$	0	-4

$\therefore x = 5$ IS A MAX.

· MUST SHOW $\frac{dA}{dx}$ NUMBERS.

· SHOW ALL SIDES ARE EQUAL.

$DP = \sqrt{100-5^2}$ ... FROM i.

$= \sqrt{75} = 5\sqrt{3}$

$DF = 2 \times DP$

$= 10\sqrt{3}$ ... 1ST SIDE

$DE^2 = (10+5)^2 + (\sqrt{75})^2$

$= 225 + 75$

$= 300$

$DE = \sqrt{300} = 10\sqrt{3}$ ... 2ND SIDE

$DF = DE = 10\sqrt{3}$ ... 3RD SIDE

$\therefore$ EQUILATERAL TRIANGLE!

END! PHEW!