THE STUDENT HUB

CSEC Add Maths

Paper 2

June 2023

Solutions

SECTION I

ALGEBRA, SEQUENCES AND SERIES

ALL working must be clearly shown.

1. (a) Solve the equation $3^{2x+1} - 5(3^x) - 2 = 0$, giving your answer to 3 decimal places. [5]

$$3^{2x+1} - 5(3^x) - 2 = 0$$

$$3^{2x} \cdot 3^1 - 5(3^x) - 2 = 0$$

$$3 \cdot (3^x)^2 - 5(3^x) - 2 = 0$$

Let $y = 3^x$.

$$3y^2 - 5y - 2 = 0$$

$$(3y + 1)(y - 2) = 0$$

Either	$3y + 1 = 0$	or	$y - 2 = 0$
	$3y = -1$		$y = 2$
	$y = -\frac{1}{3}$		$3^x = \frac{2}{3}$
	$3^x = -\frac{1}{3}$		$\log 3^x = \log 2$
	(No Solution)		$x \log 3 = \log 2$
			$x = \frac{\log 2}{\log 3}$
			$x = 0.631$ (to 3 d.p.)

$\therefore x = 0.631$ (to 3 decimal places)

(b) (i) Given that $3x + 2$ is a factor of $3x^3 + bx^2 - 3x - 2$, find the value of b. [3]

Consider,

$3x + 2 = 0$

$3x = -2$

$x = -\frac{2}{3}$

Let $f(x) = 3x^3 + bx^2 - 3x - 2$.

Since $(3x + 2)$ is a factor of $f(x)$, then by the Factor Theorem, $f\left(-\frac{2}{3}\right) = 0$.

So, we have,

$f\left(-\frac{2}{3}\right) = 3\left(-\frac{2}{3}\right)^3 + b\left(-\frac{2}{3}\right)^2 - 3\left(-\frac{2}{3}\right) - 2$

$0 = 3\left(-\frac{8}{27}\right) + b\left(\frac{4}{9}\right) + 2 - 2$

$0 = -\frac{8}{9} + \frac{4}{9}b$

$(\times 9)$

$0 = -8 + 4b$

$4b = 8$

$b = \frac{8}{4}$

$b = 2$

$\therefore$ The value of $b = 2$.

(ii) Hence, factorize completely $3x^3 + bx^2 - 3x - 2$. [3]

Since $b = 2$, then, $f(x) = 3x^3 + 2x^2 - 3x - 2$.

We are given that $(3x + 2)$ is a factor of $f(x)$.

By long division,

$$x^2 + 0x - 1$$

$$3x + 2 \mid \overline{3x^3 + 2x^2 - 3x - 2}$$

$$3x^3 + 2x^2$$

$$\overline{0x^2 - 3x}$$

$$0x^2 + 0x$$

$$\overline{-3x - 2}$$

$$\underline{-3x - 2}$$

$$\underline{\quad 0 \quad}$$

Hence,

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

$$= (3x + 2)(x^2 - 1)$$

$$= (3x + 2)(x + 1)(x - 1)$$

(c) Determine the value(s) of p for which the function $px^2 + 3x + 2p$ has two real distinct roots, giving your answer in its simplest form. [4]

The given function is $px^2 + 3x + 2p$ which is in the form $ax^2 + bx + c$, where $a = p, b = 3$ and $c = 2p$.

The function has two real distinct roots when the determinant is greater than zero.

So, we have,

$$b^2 - 4ac > 0$$

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

$$9 - 8p^2 > 0$$

$$-8p^2 > -9$$

$$p^2 < \frac{-9}{-8}$$

$$p^2 < \frac{9}{8}$$

$$p < \sqrt{\frac{9}{8}}$$

$$p < \frac{\sqrt{9}}{\sqrt{8}}$$

$$p < \frac{3}{\sqrt{4 \times 2}}$$

$$p < \frac{3}{\sqrt{4} \times \sqrt{2}}$$

$$p < \frac{3}{2\sqrt{2}}$$

∴ The values of p for which the function $px^2 + 3x + 2p$ has two real distinct roots are $p < \frac{3}{2\sqrt{2}}$.

Total: 15 marks

2. Given that $f(x) = 3x^2 - 9x + 1$,

(a) (i) express $f(x)$ in the form $a(x+b)^2 + c$, where a, b and c are real numbers [3]

$$f(x) = 3x^2 - 9x + 1$$
$$= 3(x^2 - 3x) + 1$$
$$= 3\left(x^2 - 3x + \frac{9}{4}\right) + 1 - 3\left(\frac{9}{4}\right)$$
$$= 3\left(x - \frac{3}{2}\right)^2 + 1 - \frac{27}{4}$$
$$= 3\left(x - \frac{3}{2}\right)^2 - \frac{23}{4}$$

which is in the form $a(x+b)^2 + c$,

where $a = 3, b = -\frac{3}{2}$ and $c = -\frac{23}{4}$

(ii) state the coordinates of the minimum point of $f(x)$. [2]

$$f(x) = 3\left(x - \frac{3}{2}\right)^2 - \frac{23}{4}$$

which is in the form $a(x+h)^2 + k$,

where $a = 3, h = -\frac{3}{2}$ and $k = -\frac{23}{4}$.

The minimum point is of the form $(-h, k)$ which is $\left(\frac{3}{2}, -\frac{23}{4}\right)$.

$\therefore$ The coordinates of the minimum point is $\left(\frac{3}{2}, -\frac{23}{4}\right)$.

(b) The equation $3x^2 - 6x - 2 = 0$ has roots α and β. Find the value of $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$. [4]

$3x^2 - 6x - 2 = 0$ which is in the form $ax^2 + bx + c = 0$,

where $a = 3, b = -6$ and $c = -2$.

Consider,

$$\alpha + \beta = -\frac{b}{a}$$
$$= \frac{-(-6)}{3}$$
$$= \frac{6}{3}$$
$$= 2$$

And,

$$\alpha\beta = \frac{c}{a}$$
$$= -\frac{2}{3}$$

Now,

$$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\beta + \alpha}{\alpha\beta}$$
$$= \frac{2}{\left(-\frac{2}{3}\right)}$$
$$= 2 \div -\frac{2}{3}$$
$$= 2 \times -\frac{3}{2}$$
$$= -3$$

(c) John's grandparents started a university fund for him at a bank, with \$4000.

The bank offered two options for interest.

Option 1 – \$240 per annum

Option 2 – 5% of the current balance per annum

Determine the sum of money in the university fund at the beginning of the ninth year for **both** options. [6]

Consider Option 1.

At beginning of the first year, $A = 4000$

At beginning of the second year, $A = 4000 + 240$

At beginning of the second year, $A = 4000 + 240 + 240$

Notice that it follows an arithmetic progression where $a = 4000$ and $d = 240$.

For the beginning of the nth year,

$T_n = a + (n - 1)d$

$T_n = 4000 + (n - 1)(240)$

Now, to calculate the sum of money at the beginning of the ninth year,

$T_9 = 4000 + (9 - 1)(240)$

$= 4000 + (8)(240)$

$= 4000 + 1920$

$= 5920$

Now,

Consider Option 2.

At beginning of the first year, $A = 4000$

At beginning of the second year, $A = 4000(1.05)$

At beginning of the second year, $A = 4000(1.05)^2$

Notice that it follows a geometric progression where $a = 4000$ and $r = 1.05$.

For the beginning of the nth year,

$T_n = ar^{n-1}$

$T_n = 4000(1.05)^{n-1}$

Now, to calculate the sum of money at the beginning of the ninth year,

$T_9 = 4000(1.05)^{9-1}$

$= 4000(1.05)^8$

$= 5909.82$

∴ The sum of money at the beginning of the ninth year for Option 1 is \$5920.

∴ The sum of money at the beginning of the ninth year for Option 2 is \$5909.82.

Total: 15 marks

SECTION II

COORDINATE GEOMETRY, VECTORS AND TRIGONOMETRY

ALL working must be clearly shown.

3. (a) The equation of a circle is $x^2 + y^2 - 8x - 18y + 93 = 0$.

(i) Determine the coordinates of the centre of the circle. [2]

$x^2 + y^2 - 8x - 18y + 93 = 0$

which is in the form $x^2 + y^2 + 2fx + 2gy + c = 0$,

where $2f = -8$ and $2g = -18$.

So, we have,

$2f = -8$ and $2g = -18$

$f = \frac{-8}{2}$ $\quad$ $g = \frac{-18}{2}$

$f = -4$ $\quad$ $g = -9$

$-f = -(-4)$ $\quad$ $-g = -(-9)$

$-f = 4$ $\quad$ $-g = 9$

Now, the centre of the circle is of the form $(-f, -g)$.

$\therefore$ The centre of the circle is $(4, 9)$.

Alternatively,

We can consider the standard form of the equation of the circle.

$$x^2 + y^2 - 8x - 18y + 93 = 0$$

$$x^2 - 8x + y^2 - 18y = -93$$

$$x^2 - 8x + 16 + y^2 - 18y + 81 = -93 + 16 + 81$$

$$(x-4)^2 + (y-9)^2 = 4$$

which is in the form $(x-a)^2 + (y-b)^2 = r^2$,

where $C(4, 9)$ and $r = 2$.

(ii) Find the length of the radius. [1]

$x^2 + y^2 - 8x - 18y + 93 = 0$

which is in the form $x^2 + y^2 + 2fx + 2gy + c = 0$,

where $f = -4$, $g = -9$ and $c = 93$.

Now,

$r = \sqrt{f^2 + g^2 - c}$

$= \sqrt{(-4)^2 + (-9)^2 - 93}$

$= \sqrt{16 + 81 - 93}$

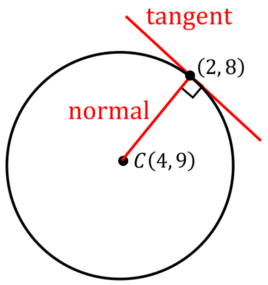
$= \sqrt{4}$

$= 2$ units

$\therefore$ The length of the radius, $r = 2$ units.

(iii) Find the equation of the normal to the circle at the point $(2, 8)$. [3]

Consider the sketch below.



Points are $(2, 8)$ and $(4, 9)$.

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{9-8}{4-2}$

$= \frac{1}{2}$

Substituting $m = \frac{1}{2}$ and point $(2, 8)$ into $y - y_1 = m(x - x_1)$ gives:

$y - 8 = \frac{1}{2}(x - 2)$

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

$y = \frac{1}{2}x - 1 + 8$

$y = \frac{1}{2}x + 7$

$\therefore$ The equation of the normal is: $y = \frac{1}{2}x + 7$

(b) The position vectors of two points, A and B, relative to an origin O, are such that $\overrightarrow{OA} = 3\hat{\boldsymbol{\imath}} - \hat{\boldsymbol{\jmath}}$ and $\overrightarrow{OB} = 5\hat{\boldsymbol{\imath}} - 4\hat{\boldsymbol{\jmath}}$. Determine

(i) the unit vector $\boldsymbol{AB}$ [3]

$\overrightarrow{OA} = 3\hat{\boldsymbol{\imath}} - \hat{\boldsymbol{\jmath}}$

$= \begin{pmatrix} 3 \\ -1 \end{pmatrix}$

$\overrightarrow{OB} = 5\hat{\boldsymbol{\imath}} - 4\hat{\boldsymbol{\jmath}}$

$= \begin{pmatrix} 5 \\ -4 \end{pmatrix}$

Using the triangle law,

$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$

$= \begin{pmatrix} 5 \\ -4 \end{pmatrix} - \begin{pmatrix} 3 \\ -1 \end{pmatrix}$

$= \begin{pmatrix} 5-3 \\ -4-(-1) \end{pmatrix}$

$= \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

$= 2\hat{\boldsymbol{\imath}} - 3\hat{\boldsymbol{\jmath}}$

$|\overrightarrow{AB}| = \sqrt{(2)^2 + (-3)^2}$

$= \sqrt{4+9}$

$= \sqrt{13}$

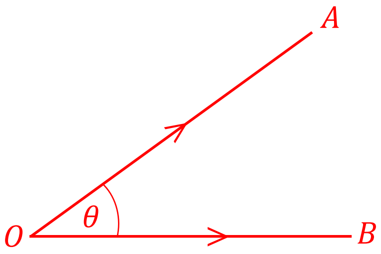
Unit vector $= \frac{\overrightarrow{AB}}{|\overrightarrow{AB}|}$

$= \frac{2\hat{\boldsymbol{\imath}} - 3\hat{\boldsymbol{\jmath}}}{\sqrt{13}}$

$= \frac{2}{\sqrt{13}}\hat{\boldsymbol{\imath}} - \frac{3}{\sqrt{13}}\hat{\boldsymbol{\jmath}}$

(ii) the acute angle $A\hat{O}B$, in degrees, to **1 decimal place.** [3]

Consider the sketch below:



$\overrightarrow{OA} = 3\hat{\boldsymbol{\imath}} - \hat{\boldsymbol{\jmath}}$

$= \begin{pmatrix} 3 \\ -1 \end{pmatrix}$

$\overrightarrow{OB} = 5\hat{\boldsymbol{\imath}} - 4\hat{\boldsymbol{\jmath}}$

$= \begin{pmatrix} 5 \\ -4 \end{pmatrix}$

$\overrightarrow{OA} \cdot \overrightarrow{OB} = \begin{pmatrix} 3 \\ -1 \end{pmatrix} \cdot \begin{pmatrix} 5 \\ -4 \end{pmatrix}$

$= (3)(5) + (-1)(-4)$

$= 15 + 4$

$= 19$

$\left|\overrightarrow{OA}\right| = \sqrt{(3)^2 + (-1)^2}$

$= \sqrt{9 + 1}$

$= \sqrt{10}$

$\left|\overrightarrow{OB}\right| = \sqrt{(5)^2 + (-4)^2}$

$= \sqrt{25 + 16}$

$= \sqrt{41}$

Now,

$\cos\theta = \frac{\overrightarrow{OA}\cdot\overrightarrow{OB}}{|\overrightarrow{OA}||\overrightarrow{OB}|}$

$\cos\theta = \frac{19}{\sqrt{10}\sqrt{41}}$

$\theta = \cos^{-1}\left(\frac{19}{\sqrt{10}\sqrt{41}}\right)$

$\theta = 20.2°$ (to 2 significant figures)

$\therefore$ The acute angle $A\hat{O}B = 20.2°$.

(c) Solve the equation $2\sin^2\theta = 3\cos\theta$ where $0° < \theta < 180°$. [4]

$2\sin^2\theta = 3\cos\theta$

$2(1-\cos^2\theta) = 3\cos\theta$

$2 - 2\cos^2\theta = 3\cos\theta$

$2\cos^2\theta + 3\cos\theta - 2 = 0$

Let $y = \cos\theta$.

$2y^2 + 3y - 2 = 0$

$(2y-1)(y+2) = 0$

Either	$2y - 1 = 0$	or	$y + 2 = 0$
	$2y = 1$		$y = -2$
	$y = \frac{1}{2}$		$\cos\theta = -2$
	$\cos\theta = \frac{1}{2}$		

Consider,

$\cos\theta = \frac{1}{2}$

$\theta = \cos^{-1}\left(\frac{1}{2}\right)$

$\theta = 60°$

Consider,

$\cos\theta = -2$

(No solution since $-1 \leq \cos\theta \leq 1$)

$\therefore \theta = 60°$ where $0° < \theta < 180°$.

(d) Prove the identity $\frac{1}{1-\sin x} - \frac{1}{1+\sin x} = \frac{2\tan x}{\cos x}$. [4]

Taking L.H.S:

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

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

$$= \frac{2\sin x}{\cos^2 x}$$

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

$$= \frac{2\tan x}{\cos x}$$

$$= \text{R.H.S.}$$

$\therefore \frac{1}{1-\sin x} - \frac{1}{1+\sin x} = \frac{2\tan x}{\cos x}$ Q.E.D.

Total: 20 marks

SECTION III

INTRODUCTORY CALCULUS

ALL working must be clearly shown.

4. (a) A function given by $y = ax^2 + bx + c$ has a gradient of $9 - \frac{1}{2}x$ at a stationary value of 5.

(i) Determine the values of a, b and c in the function. [5]

$y = ax^2 + bx + c$

$\frac{dy}{dx} = 2ax + b$ → Equation 1

We are given that

$\frac{dy}{dx} = 9 - \frac{1}{2}x$

$\frac{dy}{dx} = -\frac{1}{2}x + 9$ → Equation 2

Comparing Equation 1 and Equation 2 gives:

$2a = -\frac{1}{2}$, $b = 9$

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

$a = -\frac{1}{4}$

At stationary values, $\frac{dy}{dx} = 0$.

When $\frac{dy}{dx} = 0$,

$9 - \frac{1}{2}x = 0$

$-\frac{1}{2}x = -9$

$x = -9 \times -2$

$x = 18$

The stationary value occurs at $y = 5$. The stationary point is $(18, 5)$.

Substituting $a = -\frac{1}{4}, b = 9$ and $(18, 5)$ into $y = ax^2 + bx + c$ gives:

$5 = -\frac{1}{4}(18)^2 + (9)(18) + c$

$5 = -81 + 162 + c$

$5 = 81 + c$

$c = 5 - 81$

$c = -76$

$\therefore$ The values of a, b and c are $a = -\frac{1}{4},\ b = 9$ and $c = -76$.

(ii) Determine the nature of the stationary point. [2]

$\frac{dy}{dx} = 9 - \frac{1}{2}x$

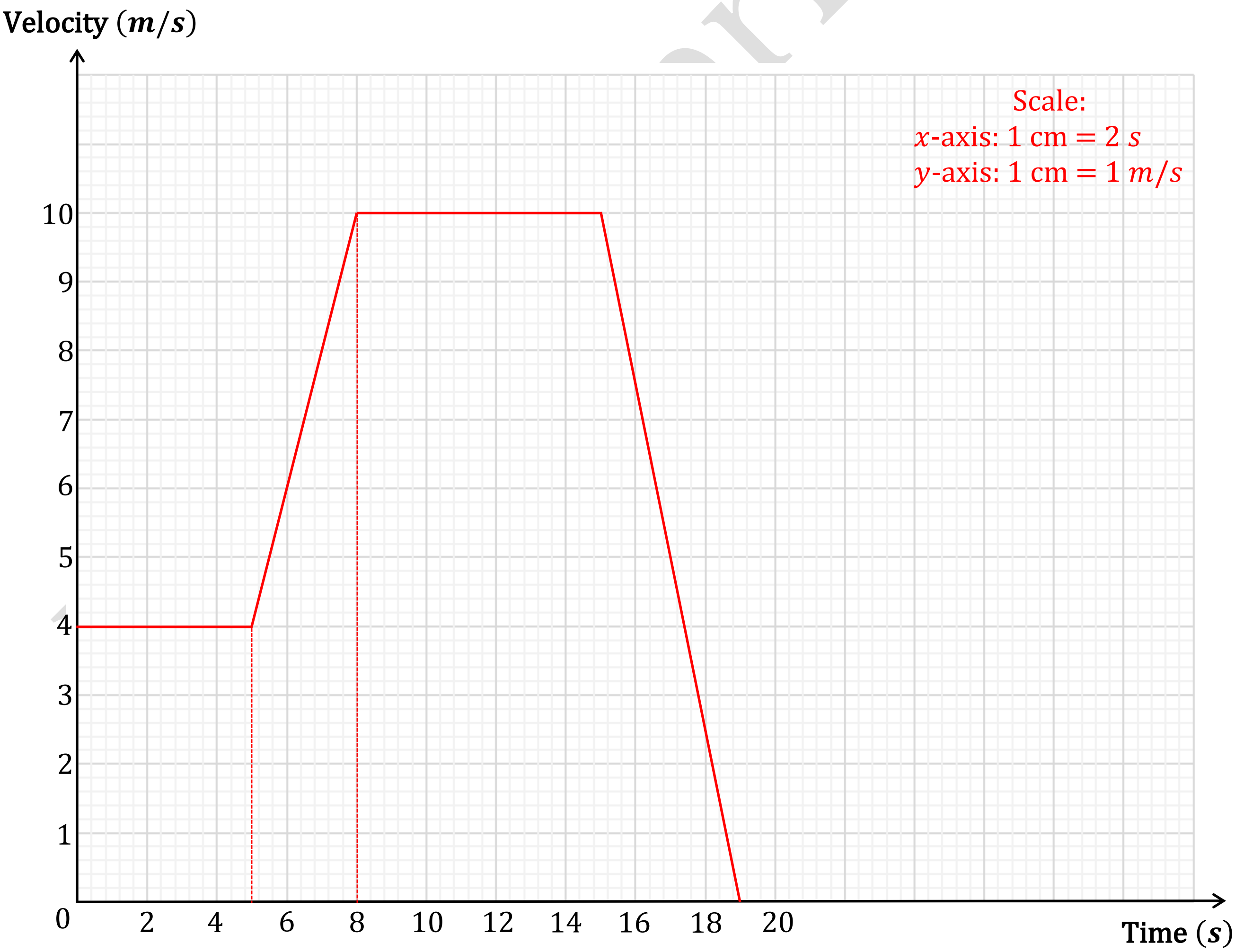
$\frac{d^2y}{dx^2} = -\frac{1}{2}\ \ (< 0)$

Since $\frac{d^2y}{dx^2} < 0$, then the stationary point is a maximum point.

(b) A drone tracks the movement of an object in motion on the ground. The following movements are recorded.

- It moves at a constant velocity of 4 m/s for 5 seconds.
- Its velocity increases uniformly for 3 seconds to 10 m/s.
- It moves at that velocity for 7 seconds.
- It slows uniformly until it comes to rest after 4 seconds.

(i) Sketch the graph of the movement of the object. [3]



(ii) Calculate the distance travelled by the object in the second part of the journey. [3]

Distance travelled = Area under the graph

$= \frac{1}{2}(a + b)h$

$= \frac{1}{2}(4 + 10)(3)$

$= 21\ m$

$\therefore$ The distance travelled by the object in the second part of the journey is $21\ m$.

(iii) Determine the object's acceleration in the final part of the journey. [2]

Points are $(15, 10)$ and $(19, 0)$.

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{0-10}{19-15}$

$= \frac{-10}{4}$

$= -2.5\ ms^{-2}$

$\therefore$ The acceleration in the final part of the journey is $-2.5\ ms^{-2}$.

Total: 15 marks

5. (a) Consider a toy moving along a miniaturized racing course with an acceleration of $a(t) = 9t^2 + 2t - 1$, where t is the time in seconds. Assume that the speed of the toy truck is measured in cm/second.

(i) Outline how an equation for the speed of the truck would be found, using the given equation for the acceleration. [1]

$a(t) = 9t^2 + 2t - 1$

$v = \int a(t)\ dt$

$v = \int (9t^2 + 2t - 1)\ dt$

$v = \frac{9t^3}{3} + \frac{2t^2}{2} - t + c$

$v = 3t^3 + t^2 - t + c$

When $t = 0, v = 0$.

$0 = 3(0)^3 + (0)^2 - (0) + c$

$0 = 0 + c$

$c = 0$

∴ An equation for the speed of the truck is: $v = 3t^3 + t^2 - t$

(ii) Find the speed of the truck at $t = 10$ seconds. [3]

$v = 3t^3 + t^2 - t$

When $t = 10$,

$v = 3(10)^3 + (10)^2 - (10)$

$\quad = 3(1000) + 100 - 10$

$\quad = 3090\ cms^{-1}$

$\therefore$ The speed of the truck is 3090 cms^{-1}.

(iii) Find the distance covered by the truck between 5 and 10 seconds. Express your answer to **the nearest whole number**. [4]

The distance covered by the truck is:

$s = \int_a^b v(t)\,dt$

$\quad = \int_5^{10} (3t^3 + t^2 - t)\,dt$

$\quad = \left[\frac{3t^4}{4} - \frac{t^3}{3} - \frac{t^2}{2}\right]_5^{10}$

$\quad = \left[\frac{3(10)^4}{4} + \frac{(10)^3}{3} - \frac{(10)^2}{2}\right] - \left[\frac{3(5)^4}{4} + \frac{(5)^3}{3} - \frac{(5)^2}{2}\right]$

$\quad = \frac{23350}{3} - \frac{5975}{12}$

$\quad = 7285\ cm$ (to the nearest whole number)

$\therefore$ The distance covered by the truck between 5 and 10 seconds is 7285 cm.

(b) Find

(i) $\int (2x+3)^2 \ dx$ [2]

$\int (2x+3)^2 \ dx$

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

$= \frac{(2x+3)^3}{6} + c$

(ii) $\int 5\cos 2x \ dx$ [2]

$\int 5\cos 2x \ dx$

$= 5\int \cos 2x \ dx$

$= 5\left(\frac{1}{2}\sin 2x\right) + c$

$= \frac{5}{2}\sin 2x + c$

(c) If $\frac{dy}{dx} = 6x - 10$ and $y = 12$ when $x = 0$, find the equation for y in terms of x. [3]

$\frac{dy}{dx} = 6x - 10$

$y = \int \frac{dy}{dx} \ dx$

$y = \int (6x - 10) \ dx$

$y = \frac{6x^2}{2} - 10x + c$

$y = 3x^2 - 10x + c$

Substituting $y = 12$ and $x = 0$ gives,

$12 = 3(0)^2 - 10(0) + c$

$12 = 0 + c$

$c = 12$

$\therefore$ The equation is $y = 3x^2 - 10x + 12$.

Total: 15 marks

SECTION IV

PROBABILITY AND STATISTICS

ALL working must be clearly shown.

6. The following stem and leaf diagram represents the scores, out of 80, of students in an Additional Mathematics exam.

3	0	3	7		
4	2	4	6	7	9
5	1	3	3	6	
6	0	7	7		
7	1	9			

(a) Write the raw data set that was used to construct the diagram above. [2]

The raw data set is:

30 33 37

42 44 46 47 49

51 53 53 56

60 67 67

71 79

(b) Determine the following measures for the data set.

(i) The median exam score [2]

The data is placed in ascending order:

~~30~~ ~~33~~ ~~37~~ ~~42~~ ~~44~~ ~~46~~ ~~47~~ ~~49~~ (51) ~~53~~

~~53~~ ~~56~~ ~~60~~ ~~67~~ ~~67~~ ~~71~~ ~~79~~

∴ The median exam score is 51.

(ii) The mean exam score [2]

$$\bar{x} = \frac{\sum x}{n}$$

$$= \frac{30+33+37+42+44+46+47+49+51+53+53+56+60+67+67+71+79}{17}$$

$$= \frac{885}{17}$$

$= 52.1$ (to 3 significant figures)

∴ The mean exam score is 52.1.

(iii) The modal score(s) [2]

The modal scores are 53 and 67.

(iv) Given that for the data set $\sum x^2 = 48999$ and $\sum x = 885$, find the standard deviation of the data set using the formula [4]

$$S = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

$$S = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

Substituting $\sum x^2 = 48999$, $\sum x = 8$ and $n = 17$ gives:

$$S = \sqrt{\frac{48999 - \frac{(885)^2}{17}}{17-1}}$$

$$= \sqrt{\frac{48\,999 - \frac{783\,225}{17}}{16}}$$

$= 13.5$ (to 3 significant figures)

∴ The standard deviation of the data set is 13.5.

(c) If a student needed to score at least half the total marks possible to pass the exam, determine the probability of a student failing the exam. Give your answer to **2 decimal places**. [2]

The total marks is 80.

Now, $\frac{1}{2}(80) = 40$

In order to pass the exam, the student needs more than or equal to 40 marks.

If the student failed the exam, they received a mark less than 40.

The are three scores less than 40: 30, 33 and 37.

$$\text{Probability} = \frac{\textit{Number of possible outcomes}}{\textit{Total number of outcomes}}$$

$$= \frac{3}{17}$$

$$= 0.176 \qquad \text{(to 3 significant figures)}$$

∴ The probability of a student failing the exam is 0.176.

(d) Given that a randomly selected student has passed the exam, what is the probability that the student scored over 60? Give your answer to **2 decimal places.** [2]

Let A be the event that the student scored over 60.

Let B be the event that the student passed the exam.

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$= \frac{\left(\frac{5}{17}\right)}{\left(\frac{14}{17}\right)}$$

$$= \frac{5}{17} \div \frac{14}{17}$$

$$= \frac{5}{17} \times \frac{17}{14}$$

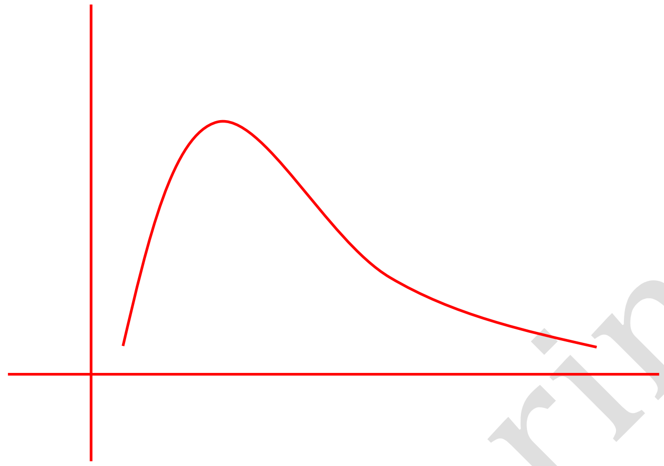
$$= \frac{5}{14}$$

$$= 0.36 \qquad \text{(to 2 decimal places)}$$

∴ Given that a randomly selected student has passed the exam, the probability that the student scored over 60 is 0.36.

(e) Based on the given stem and leaf diagram, describe the distribution of the data set. [2]

The data set is positively skewed.



(f) Your friend suggested that a bar graph or histogram could be used to represent the data. Advise your friend on which graph is the better option giving ONE reason to support your answer. [2]

The scores are of students in an Additional Mathematics exam is discrete data. Therefore, the better option is a bar graph since a bar graph is used for discrete data.

Total: 20 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.