1 Using the laws of algebra of sets, show that
$A-(B \cup C) = (A-B) \cap (A-C)$ [3]

2 Show that $\sqrt{2}$ is a zero of the polynomial $p(x) = 2x^4 + x^3 - 3x^2 - 2x - 2$. Hence, obtain all the roots of the equation $p(x) = 0$. [3]

3 Given that $(x + iy)^2 = -5 + 12i$, where x and y are real, find the set of possible values of $x + iy$. By completion of the square, solve $z^2 + 4z = -9 + 12i$. [4]

4 Given that $\mathbf{v\,e^{kt} = A\sin\alpha t + B\cos\alpha t}$, A, B being arbitrary constants and k, α given fixed constants, find the values of p and q in terms of k and α such that
$$\frac{d^2v}{dt^2} + p\frac{dv}{dt} + qv = 0$$ [5]

5 Find $\int x\ln(1+x)dx$. Hence, evaluate $\int_0^e x\ln(1+x)dx$ leaving the answer in the form of e. [6]

6 The tangent at any point P $(at^2, 2at)$ of the curve $y^2 = 4ax$ meets the tangent at the origin at the point Q. S is the point (a, 0) and SQ meets the line through P parallel to the tangent at the origin at the point N. Find the locus of N. [8]

7 Show that, if x is so small that powers of x higher than its cube may be ignored,
$(1+x)^{\frac{1}{5}} = \frac{5+3x}{5+2x} + ax^3$ where a is a numerical constant whose value is to be determined. By giving x a suitable value, find the difference between the fifth root of 1.02 and $\frac{253}{252}$. [10]

8 (a) Given that $A = \begin{pmatrix} -1 & 2 \\ 4 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 1 \\ x & y \end{pmatrix}$ where $x \neq y$, find the values of x and y such that $\mathbf{B^{-1}AB}$ is a diagonal matrix.
(b) Given that $C = \begin{pmatrix} 3 & 2 \\ -8 & -3 \end{pmatrix}$, evaluate $\mathbf{C}^5$ and $\mathbf{C}^6$. [10]

9 Express $\frac{x(x+6)}{(x+2)(x+4)}$ in partial fractions.
Hence, find the sum of the series $\frac{1\text{x}7}{3\text{x}5} + \frac{2\text{x}8}{4\text{x}6} + \frac{3\text{x}9}{5\text{x}7} + \ldots + \frac{n(n+6)}{(n+2)(n+4)}$. [10]

10 Function f is defined by $\mathbf{f(x)} = \begin{cases} |2x+1| - |1-x| - 2x & x < 2 \\ 1 & x \geq 2 \end{cases}$.

(i) Sketch the graph of f and state its range.
(ii) State whether f is continuous at x = 2 giving reasons.
(iii) Solve the inequality $|2x+1| \geq |1-x| + 2x$ for $x < 2$. [12]

11 The equation of a curve is $y = \dfrac{x^2}{x^2 - 5x + 6}$. Find the asymptotes and stationary points of the curve. Sketch the curve.
Determine the number of real roots of the equation $p(x-2)(x-3)^2 = x^2$ where $p < 0$. [13]

12 State the asymptotes for the curve $y = \dfrac{x}{2+x}$. Hence, sketch the curve.
Find the area enclosed by the curve , the x-axis and the line x = 1 by using
(i) trapezium rule with 5 ordinates,
(ii) integration.
Give your answer correct to 4 decimal places and calculate the percentage error in the estimation when the trapezium rule is used.
Find also the volume of the solid formed when this area is rotated completely about the x-axis. [16]

END OF QUESTION PAPER

1. In triangle ABC, AB = P, BC = 3p, and $\angle$ABC = 60°. The bisector of the angle ABC meets AC at the point T. Find AT and CT in terms of p. [6]

2. Find y in term of x given that $e^x \cos y + (1 + e^x) \sin y \frac{dy}{dx} = 0$ and that y = 0 when x=0. [5]

3. Prove that $\cos x + 2\cos 2x + \cos 3x = 4\cos 2x \cos^2 \frac{1}{2} x$. Hence, find all the values of x in [0, 2π] for which $\cos x + 2\cos 2x + \cos 3x = 0$. [7]

4. The points A, B have ~~positive~~ position. vectors $\underset{\sim}{a}$, $\underset{\sim}{b}$ respectively, referred to an origin O. The point C lies on AB between A and B and is such that AC : CB = 2 : 1 and D is the mid-point of OC. The line AD produced meets OB at E. Find in terms of a and b, (i) the vector $\overrightarrow{OC}$ (ii) the vector $\overrightarrow{AD}$

Find the values of OE : EB and AE : ED . [10]

5. (i) Prove that the angle that the chord makes with the tangent is equal to the angle in the alternate segment of the circle. [4]

(ii) Two circles PQR and PQS intercept at P and Q, tangent at R of circle PQR and tangent at S of circle PQS meet at T on PQ produced. If RQS is a straight line prove that (a) TRPS is a cyclic quadrilateral (b) <TPR = < TPS (c) TR = TS [6]

6. A certain drug is being administered to a patient in a hospital at a constant rate. The rate at which the drug is lost from his body is proportional to the amount x of the drug present in the body. Show that $\frac{dx}{dt} = R_0 - kx$ and explain the significance of the constants R_0 and k. If his body is initially free of the drug, find x in terms of t, R_0 and k. Show that there is a limit to the quantity of drug in the body and find this limit in terms of R_0 and k. Sketch a graph of x against t. The half-life T of the drug is defined to be the time taken for the amount of drug in the body to fall by one half when administration is stopped. Find T in term of k. [12]

7. A company is considering introducing a new product, but is uncertain of the likely demand for it. The marketing manager thinks that the probability of strong demand for the product is 0.5 , average demand 0.3 and weak demand 0.2. Previous experience of launching new products suggests that if the marketing manager thinks the demand will be strong there is a 0.8 probabilty of high profits and a 0.2 probabilty of a loss ; the corresponding probabilities for average demand are 0.6 and 0.4 and for weak demand are 0.3 and 0.7 respectively.

(a) Assuming that the product is introduced, find the probability that high profits will be achieved. [3]

(b) If high profits were in fact achieved initially, find the revised probability that demand would be strong in the future. [3]

(c) It is estimated that if profits were high ~~the~~, the profit would be RM300,000. If a loss were made, the loss would be RM50,000. Find the expected profit (or loss) if the product is introduced. [3]

8. The continuous random variable X has the probability density function f(x) defined by

$$f(x) = \begin{cases} \frac{1}{3}x - \frac{2}{3}, & 2 \le x < 3 \\ \frac{1}{3} & 3 \le x < 5 \\ 2 - \frac{1}{3}x & 5 \le x < 6 \\ 0 & \text{otherwise} \end{cases}$$

Find the cumulative distribution function F (x) and hence find (i) the median (ii) P ($x \ge 5.5$) [8]

9. The lifespan of an electrical instrument produced by a manufacturer is normally distributed with a mean of 72 months and a standard deviation of 15 months.

(i) If the manufacturer quarantees that the lifespan of an electrical instrument is at least 36 months, calculate the percentage of the electrical instrument which have to be replaced free of charge. [3]

(ii) If the manufacturer specifies that less than 0.1 % of the electrical instrument have to be replaced free of charge, determine the greatest length of the guarantee period correct to the nearest month. [5]

10. The probability of a person allergie to a type of anaesthetic is 0.002. A total of 2000 persons are injected with the anaesthetic. Using suitable approximate distribution, calculate the probability that more than 3 persons are allergic to the anaesthetic. [4]

11. (a) A set of numbers has mean 23 and standard deviation 7. A new set of numbers is obtained by subtracting 23 from each of the original numbers and then dividing the result by 7. Write down the mean and standard deviation of the new set of numbers. [4]

(b) The nine numbers 5 , 6 , 13 ,5 , 10, 13, 3 , x , y have a mean of 8 and mode of 5.

Find (I) the values of the two numbers x and y.

(ii) the median of this set of nine numbers,

(iii) the variance of this set of nine numbers. [4]

12 (a) Ten people are asked a question successively in a random order and exactly 2 of the 10 people know the answer. What is the probability that the first 3 of those asked do not knows the answer? [2]

(b) n people are asked a question successively in a random order and exactly 2 of the n know the answers. If $n > 5$, what is the probability that the first 4 of those asked do not know the answer?

Show that the probability that the rth person asked is the first to know the answer is $\frac{2(n-r)}{n(n-1)}$ if $1 < r < n$. Show that this expression for the probability also holds when $r = 1$ or $r = n$.

Verify that the sum of these probabilities over all possible values of r is 1, and show that the expected number of people to asked before the correct answer is obtained is $\frac{(n+1)}{3}$. [11]

---THE END---

Maths T1/S1 Trial Exam 2010

1. $A - (B \cup C)$

$= A \cap (B \cup C)'$

$= A \cap (B' \cap C')$

$= (A \cap B') \cap (A \cap C')$

$= (A - B) \cap (A - C)$

2. $P(x) = 2x^4 + x^3 - 3x^2 - 2x - 2$

$P(\sqrt{2}) = 2(2)(2) + 2\sqrt{2} - 3(2) - 2\sqrt{2} - 2$

$= 0$ conjugate factor

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

$P(x) = (x^2 - 2)(2x^2 + Bx + 1)$

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

$P(x) = 0$

$x = \sqrt{2} \quad x = -\sqrt{2} \quad x = \dfrac{-1 \pm \sqrt{1-8}}{2(2)}$

$x = \dfrac{-1 \pm \sqrt{7}\, i}{4}$

3. $(x + iy)^2 = -5 + 12i$

$x^2 - y^2 + 2xyi = -5 + 12i$

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

$2xy = 12$

$y = \dfrac{6}{x}$

$x^2 - \dfrac{36}{x^2} = -5$

$x^4 + 5x^2 - 36 = 0$

$(x^2 - 4)(x^2 + 9) = 0$ x, y are real.

$x^2 = 4 \quad x^2 = -9$ (rejected)

$x = \pm 2$

$x = 2, \; y = 3 \qquad 2 + 3i$

$x = -2, \; y = -3 \qquad -2 - 3i$

$z^2 + 4z = -9 + 12i$

$(z + 2)^2 = 4 - 9 + 12i = -5 + 12i$

$z + 2 = 2 + 3i \qquad z = 3i$

$z + 2 = -2 - 3i \qquad z = -4 - 3i$

4. $ve^{kt} = A \sin \alpha t + B \cos \alpha t$

$\dfrac{dv}{dt} e^{kt} + vke^{kt} = A\alpha \cos \alpha t - B\alpha \sin \alpha t$

$\dfrac{d^2v}{dt^2} e^{kt} + \dfrac{dv}{dt} ke^{kt} + \dfrac{dv}{dt} ke^{kt} + vk^2 e^{kt}$

$= -A\alpha^2 \sin \alpha t - B\alpha^2 \cos \alpha t$

$\dfrac{d^2v}{dt^2} e^{kt} + \dfrac{dv}{dt} 2ke^{kt} + vk^2 e^{kt} = -\alpha^2 v e^{kt}$

$\dfrac{d^2v}{dt^2} + \dfrac{dv}{dt}(2k) + vk^2 + v\alpha^2 = 0$

$\dfrac{d^2v}{dt^2} + \dfrac{dv}{dt} p + qv = 0$

$p = 2k \quad q = k^2 + \alpha^2$

6. $P(at^2, 2at)$

$x = at^2 \qquad y = 2at$

$\dfrac{dx}{dt} = 2at \qquad \dfrac{dy}{dt} = 2a$

$\dfrac{dy}{dx} = \dfrac{2a}{2at} = \dfrac{1}{t}$

$y - 2at = \dfrac{1}{t}(x - at^2)$

$yt - 2at^2 = x - at^2$

$yt = x + at^2$

tangent at origin $x = 0$.

$yt = at^2$

$y = at$

$Q(0, at) \quad S(a, 0)$

$y - 0 = -\dfrac{at}{a}(x - a)$

SQ will be $y = -tx + at$.

$x = at^2$

$y = -t(at^2) + at = at - at^3$

$x = at^2$

$N(at^2, at - at^3)$

$x = at^2$

$y = at - at^3 = at(1-t^2)$

$y = at\left(1 - \frac{x}{a}\right)$

$y^2 = a^2t^2\left(1-\frac{x}{a}\right)^2$

$y^2 = a^2\left(\frac{x}{a}\right)\left(1-\frac{x}{a}\right)^2$

$y^2 = \frac{ax}{a^2}(a-x)^2$

$ay^2 = x(a-x)^2$

6. $\int x \ln(1+x)\,dx$

$= \ln(1+x)\left(\frac{x^2}{2}\right) - \int \frac{x^2}{2}\left(\frac{1}{1+x}\right)dx$

$= \frac{x^2}{2}\ln(1+x) - \frac{1}{2}\int \frac{x^2}{1+x}\,dx$

$= \frac{x^2}{2}\ln(1+x) - \frac{1}{2}\int x - 1 + \frac{1}{1+x}\,dx$

$= \frac{x^2}{2}\ln(1+x) - \frac{1}{2}\left[\frac{x^2}{2} - x + \ln(x+1)\right]$

$\int_0^e x\ln(1+x)\,dx = \left[\frac{x^2}{2}\ln(1+x)\right]_0^e - \frac{1}{2}\left[\frac{x^2}{2} - x + \ln(x+1)\right]_0^e$

$= \frac{e^2}{2}\ln(1+e) - \frac{1}{4}e^2 + \frac{1}{2}e - \frac{\ln(e+1)}{2}$

$= \frac{1}{2}\ln(e+1)(e^2-1) - \frac{e^2}{4} + \frac{1}{2}e$. 2

$\frac{1}{2}(e^2-1)\ln(1+e)$

7. $(1+x)^{\frac{1}{5}} = 1 + \frac{1}{5}x + \frac{(\frac{1}{5})(-\frac{4}{5})}{1\cdot 2}x^2 + \frac{(\frac{1}{5})(-\frac{4}{5})(-\frac{9}{5})}{1\cdot 2\cdot 3}x^3 + \ldots$

$= 1 + \frac{1}{5}x - \frac{2}{25}x^2 + \frac{6}{125}x^3 + \ldots$ 2

$\frac{(5+3x)}{(5+2x)} + ax^3 = (5+3x)(5+2x)^{-1} + ax^3 + \ldots$

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

$\frac{1}{5}\left(1+\frac{2}{5}x\right)^{-1} = \frac{1}{5}\left(1 + (-1)\left(\frac{2}{5}\right)x + \frac{(-1)(-2)}{1\cdot 2}\left(\frac{2}{5}x\right)^2 + \frac{(-1)(-2)(-3)}{1\cdot 2\cdot 3}\left(\frac{2}{5}x\right)^3 + \right.$

$= \frac{1}{5}\left(1 - \frac{2}{5}x + \frac{4}{25}x^2 - \frac{8}{125}x^3 + \right.$

$\frac{1}{5}(5+3x)\left(1 - \frac{2}{5}x + \frac{4}{5}x^2 - \frac{8}{125}x^3 + \ldots\right) + ax^3$

$= \frac{1}{5}\left(5 + x - \frac{2}{5}x^2 + \frac{4}{25}x^3 + \ldots\right) + ax^3$

$= 1 + \frac{1}{5}x - \frac{2}{25}x^2 + \frac{4}{125}x^3 + ax^3$.

$\frac{4}{125}x^3 + ax^3 = \frac{6}{125}x^3 \qquad a = \frac{2}{125}$.

$(1.02)^{\frac{1}{5}} = \left(1 + \frac{2}{100}\right)^{\frac{1}{5}}$

$\frac{5 + 3(\frac{2}{100})}{5 + 2(\frac{2}{100})} + \frac{2}{125}\left(\frac{2}{100}\right)^3 = \frac{506}{504} + \frac{2}{125}\left(\frac{2}{100}\right)^3$

$= \frac{253}{252} + \frac{2}{125}(8\times 10^{-6})$

The difference is $\frac{16}{125}\times 10^{-6} = 1.28\times 10^{-7}$

8 a) $B^{-1} = \frac{1}{y-x}\begin{pmatrix} y & -1 \\ -x & 1\end{pmatrix}$

$B^{-1}AB$

$\begin{pmatrix} \frac{y}{y-x} & \frac{-1}{y-x} \\ \frac{-x}{y-x} & \frac{1}{y-x}\end{pmatrix}\begin{pmatrix} -1+2x & -1+2y \\ 4+x & 4+y\end{pmatrix}$

$\frac{y(-1+2y)}{y-x} + \frac{-4-y}{y-x} = 0$

$2y^2 - 2y - 4 = 0$

$y^2 - y - 2 = 0$

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

$y = -1 \quad y = 2$.

$\frac{-x(-1+2x)}{y-x} + \frac{4+x}{y-x} = 0$

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

$x^2 - x - 2 = 0$

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

$x = -1 ; x = 2$

$x = -1, \; y = 2$

$x = 2, \; y = -1$.

b) $\therefore C^2 = \begin{pmatrix} -7 & 0 \\ 0 & -7 \end{pmatrix} = -7I$ 1

$$C^5 = C^4 C$$
$$= (C^2)^2 C \quad 1$$
$$= 49IC = \begin{pmatrix} 147 & 98 \\ -392 & -147 \end{pmatrix} \quad 1$$

$$C^6 = C^2C^2C^2 \quad 1$$
$$= (-7I)(-7I)(-7I)$$
$$= \begin{pmatrix} -343 & 0 \\ 0 & -343 \end{pmatrix} \quad 1$$

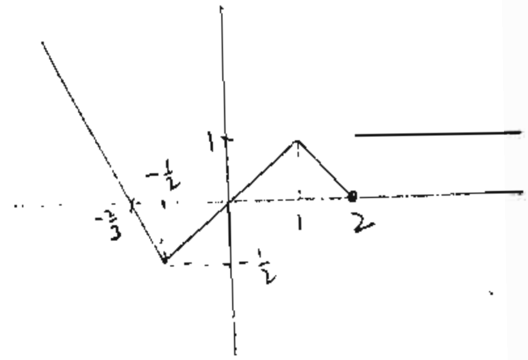
No calculator

9. $\dfrac{x(x+6)}{(x+2)(x+4)} = 1 + \dfrac{-8}{(x+2)(x+4)}$ 1

$$= 1 + \frac{-4}{x+2} \; 1 \; + \frac{4}{x+4} \quad 1$$

$$\sum_{r=1}^{n} \frac{r(r+6)}{(r+2)(r+4)} \quad 1$$
$$= \sum_{r=1}^{n}\left(1 - \frac{4}{r+2} + \frac{4}{r+4}\right) \quad 1$$
$$= n - 4\left(\tfrac{1}{3} - \cancel{\tfrac{1}{5}}\right)$$
$$4\left(\tfrac{1}{4} - \cancel{\tfrac{1}{6}}\right)$$
$$4\left(\cancel{\tfrac{1}{5}} - \tfrac{1}{7}\right) \quad 1$$
$$\vdots$$
$$4\left(\cancel{\tfrac{1}{n+1}} - \cancel{\tfrac{1}{n+3}}\right)$$
$$4\left(\cancel{\tfrac{1}{n+2}} - \tfrac{1}{n+4}\right)$$
$$= n - 4\left(\tfrac{1}{3} + \tfrac{1}{4} - \tfrac{1}{n+3} - \tfrac{1}{n+4}\right) \quad 1$$
$$= \frac{3n^3 + 14n^2 + 11n}{3(n+3)(n+4)}$$
$$= \frac{n(3n+11)(n+1)}{3(n+3)(n+4)} \quad 3$$

10. $f(x) = \begin{cases} -3x-2, & x < -\frac{1}{2} \\ x & -\frac{1}{2} \le x < 1 \\ 2-x & 1 \le x < 2 \\ 1 & x \ge 2 \end{cases}$ 3



3

range $[-\frac{1}{2}, \infty)$ 1

$\lim_{x \to 2^-} f(x) = 0$

$\lim_{x \to 2^+} f(x) = 1$ 1

Not continuous at $x = 2$. 1

$\{x : x \le -\frac{2}{3} \text{ or } 0 \le x < 2\}$ 3

11. $y = \dfrac{x^2}{x^2 - 5x + 6} = \dfrac{x^2}{(x-3)(x-2)}$

Asymptotes $x = 3$, $x = 2$, $y = 1$ 2

$$\frac{dy}{dx} = \frac{2x(x^2-5x+6) - (2x-5)x^2}{(x^2-5x+6)^2}$$
$$= \frac{12x - 5x^2}{(x^2-5x+6)^2} \quad 1$$

$x = 0 \qquad x = \frac{12}{5}$

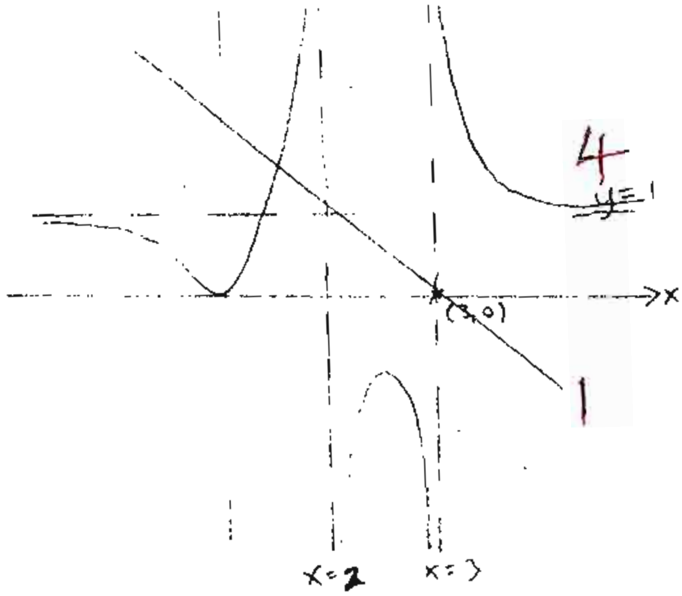
$(0, 0) \qquad (\frac{12}{5}, -24)$

	0^-	0	0^+
$\frac{dy}{dx}$	\	—	/

(0,0) min point 1

	$\frac{12}{5}^-$	$\frac{12}{5}$	$\frac{12}{5}^+$
$\frac{dy}{dx}$	/	—	\

$(\frac{12}{5}, -24)$ max. point 2



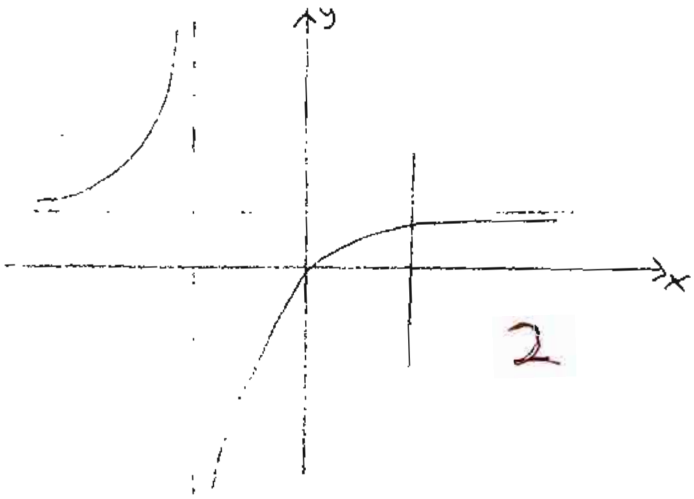
$p(x-2)(x-3)^2 = x^2$

$p(x-3) = \dfrac{x^2}{(x-2)(x-3)}$ 1

$p < 0$

There is only 1 real root. 1

12. Asymptotes $x = -2$, $y = 1$ 1



$y = 1 - \dfrac{2}{2+x}$

$h = \frac{1}{4}$ 1

x	y	
0	0	
$\frac{1}{4}$	$\frac{1}{9}$	$\frac{2}{9}$
$\frac{1}{2}$	$\frac{1}{5}$	$\frac{2}{5}$
$\frac{3}{4}$	$\frac{3}{11}$	$\frac{6}{11}$
1	$\frac{1}{3}$	
	$1\frac{248}{495}$	

2

$\text{Area} = \frac{1}{2}\left(\frac{1}{4}\right)\left(1\frac{248}{495}\right) = \frac{743}{3960}$

$= 0.1876$ 1

$\text{Area} = \displaystyle\int_0^1 \frac{x}{2+x}\,dx$

$= \displaystyle\int_0^1 1 - \frac{2}{2+x}\,dx$ 1

$= \left[x - 2\ln(2+x)\right]_0^1$ 1

$= 1 - 2\ln 3 + 2\ln 2$

$= 1 + 2\ln\frac{2}{3}$

$= 0.1891$ 2

% error $\dfrac{0.1891 - 0.1876}{0.1891} \times 100 = 0.793\,\%$ 1

$\text{Volume} = \pi\displaystyle\int_0^1 \left(\frac{x}{2+x}\right)^2 dx$

$= \pi\displaystyle\int_0^1 \left(1 - \frac{2}{2+x}\right)^2 dx$ 1

$= \pi\displaystyle\int_0^1 \left(1 - \frac{4}{2+x} + \frac{4}{(x+2)^2}\right) dx$

$= \pi\left[x - 4\ln(2+x) - \frac{4}{2+x}\right]_0^1$ 1

$= 0.0448\pi$ or 0.141 2

No.: Date:

1. $6! \times 3! = 4320$

2. a)

Stem	Leaf
30	0 4
~~35~~	~~1 2 3 3 4~~
40	0 1 1 2 2 2 3 3 4
45	0 2
50	0 1 1

Key: 35 | 1 = 36

b) Median $= Q_2 = \frac{N+1}{2}$ th

$= \frac{22}{2}$ th $= 11$ th $= 42$ ✓

Low quartile, $Q_1 = \frac{N}{4}$ th $= 5.24$ th $= 6$ th $= 38$

Upper quartile, $Q_3 = \frac{3}{4}N$ th $= 15.75$ th $= 16$ th $= 44$

3. a) $\Sigma P(Y=y) = 1$

$0.3 + m + 0.01 + 0.1 + 0.5 = 1$

$m = 0.09$

b)

$X = \frac{Y+1}{4}$	0.5	1.0	1.5	2.0	2.5
$P(X=x)$	0.3	0.09	0.01	0.1	0.5

$E(X) = \Sigma x P(X=x) = 0.5(0.3) + 0.09 + 1.5(0.01) + 2(0.1) + 2.5(0.5)$

$= 1.705$

4. a) Modal class $= 20 - 24$

$L = 19.5$, $d = 25 - 15 = 10$, $d_2 = 25 - 18 = 7$, $c = 5$

Mode $= L + \left(\frac{d_1}{d_1 + d_2}\right)c = 19.5 + \left(\frac{10}{10+7}\right)5 = 22.4$ (3 s.f.)

frequency density acceptable

Median $= \frac{N}{2}$ th $= \frac{80}{2}$ th $= 40$ th

Median class $= 20 - 24$

$L = 19.5$, $f_m = 25$, $F = 25$, $c = 5$

Median $= L + \left(\frac{\frac{N}{2} - F}{f_m}\right)c = 19.5 + \left(\frac{40-25}{25}\right)5 = 22.5$

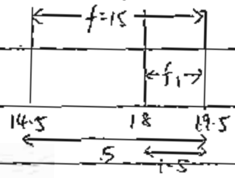
No.: median concept acceptable   Date:

4 (b) Consider the class : 15 − 19

Let f_1 = the number persons whose age between 18 and 19.5

M1 $\frac{f_1}{15} = \frac{1.5}{5}$

A1 $f_1 = 4.5 \simeq 5$



$\frac{x}{15} = \frac{2}{5}$

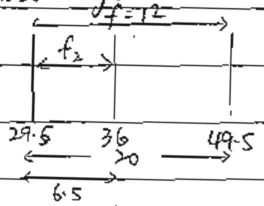
$x = 6$

Consider the class : 30 − 49

Let f_2 : the number of persons whose age between 29.5 and 36

A1 $\frac{f_2}{12} = \frac{6.5}{20}$

$f_2 = 3.9 \simeq 4$



$\frac{x}{12} = \frac{7}{20}$

$x = 4.2 \simeq 4$

∴ The number of persons whose ages are between 18 and 36

$= 5 + 25 + 18 + 4 = 52$

Percentage of persons whose age are between 18 and 36

A1 $= \frac{52}{80} \times 100 = 65\ \%$

$\frac{53}{80} \times 100\%$

$= 66.3\ \%$

5. B = Boys, G = Girls, M = students studying Mathematics.

(a) $P(M) = P(B \cap M) + P(G \cap M)$ B1

$= 0.56(\frac{1}{5}) + 0.44(\frac{1}{11})$ M1 2 A1

$= 0.152$ $\frac{19}{125}$

(b) $P(B|M') = \frac{P(B \cap M')}{P(M')}$ B1

$P(M') = 1 - P(M) = 1 - 0.152$

$= 0.848$

$= \frac{0.56(\frac{4}{5})}{0.56(\frac{4}{5}) + 0.44(\frac{10}{11})}$ M1

$= \frac{0.448}{0.848}$ M1

$0.448 = \frac{56}{125}$

$= 0.528$ (3 s.f) A1

$\frac{28}{53}$

No.: Date:

6\. a) The regression line of y on x is $y = a + bx$

where $b = \dfrac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} = \dfrac{8(2553) - 44(533)}{8(298) - (44)^2} = \dfrac{-3028}{448} = -6.759 = -6.76$ 1

$a = \bar{y} - b\bar{x}$

$= \dfrac{533}{8} - \left(-\dfrac{3028}{448}\right)\left(\dfrac{44}{8}\right)$ 1 $= 103.779 = 103.80$ 1

$\therefore$ The equation of the regression line is $y = 103.80 - 6.76x$ 1

(b) The value of a gives the value of a newly complete terrace house in the residential area is RM 103.80×10^3. 2

The value of b gives the depreciation 1 value on the house each year. The value of the house diminishes by RM 6.76×10^3 each year. 1

(c) The predicted value for the 10-years terrace house:

$[103.80 - 6.76(10)] \times 10^3 =$ RM36.2×10^3 1

The predicted value differs from the actual value because the data is only for the first 9 years, thus the value for the 10-years is just an estimate. 1

7\. (a) $\hat{p}$ = estimated of the proportion of all households that own at least 1

$\hat{p} = \dfrac{180}{250} = 0.72$ 1

$\therefore$ The percentage is 72% 1

(b) 90% confidence interval for proportion:

$\hat{p} \pm 1.645\sqrt{\dfrac{\hat{p}\hat{q}}{n}} = 0.72 \pm 1.645\sqrt{\dfrac{0.72(1-0.72)}{250}}$ 1

$= 0.72 \pm 0.0467$

$= (0.673, 0.767)$ 1

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(c) $(0.673, 0.767) = \left(\frac{n}{200} - 1.645\sqrt{\frac{\frac{n}{200}\left(1-\frac{n}{200}\right)}{200}}, \frac{n}{200} + 1.645\sqrt{\frac{\frac{n}{200}\left(1-\frac{n}{200}\right)}{200}} \right)$

Thus, $\frac{n}{200} - 1.645\sqrt{\frac{n(200-n)}{200^2(200)}} = 0.673$ ——— ①

$\frac{n}{200} + 1.645\sqrt{\frac{n(200-n)}{200^2(200)}} = 0.767$ ——— ②

① + ②, $2\left(\frac{n}{200}\right) = 1.44$

$n = 144$

8. a) Let X = the height of the lily flower, $X \sim N(110, 16.5^2)$

$P(X > 125) = P\left(Z > \frac{125-110}{16.5}\right)$

$= P(Z > 0.9091) = 0.1818 = 0.182$ (3 s.f.)

(b)(i) $X \sim N(115, \sigma^2)$. Given $P(X > 104) = 0.85$

$\Rightarrow P\left(Z > \frac{104-115}{\sigma}\right) = 0.85$

$1 - Q(z) = 0.85$

$Q(z) = 0.15$

$-1.036 = \frac{104-115}{\sigma}$

$\sigma = \cancel{10.6\ldots}$ 10.6

$\therefore$ The standard deviation, σ is $\cancel{10.6\ldots}$ 10.6

(ii) $P(X > 104) = 0.85$

Let Y = the number of the lily flowers greater than 104 cm.

$Y \sim B(10, 0.85)$

$P(Y \leq 4) = P(Y=0) + P(Y=1) + P(Y=2) + P(Y=3) + P(Y=4)$

$= {}^{10}C_0(0.85)^0(0.15)^{10} + {}^{10}C_1(0.85)(0.15)^9 + {}^{10}C_2(0.85)^2(0.15)^8 +$
${}^{10}C_3(0.85)^3(0.15)^7 + {}^{10}C_4(0.85)^4(0.15)^6$

$= 0.00138$

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If definition not given in the question must write down the definition.

9. Let x = no. of product X produced each day
y = " " " Y
z = " " " Z

The system of inequalities are: $2x + 2y + 2z \le 4000$
$2x + 3y + 4z \le 6000$
$x \ge 0, y \ge 0, z \ge 0$

To max. the profit per day, $f = 2x + 2y + 3z$ 1
Subject to: $x + y + z \le 2000$ 1
$2x + 3y + 4z \le 6000$ 1
$x \ge 0, y \ge 0, z \ge 0$ } 1

The constraints can be written in the form of equations by adding slack variable
$x + y + z + S_1 = 2000$ 1
$2x + 3y + 4z + S_2 = 6000$ 1
The objective function is $f - 2x - 2y - 3z = 0$ 1

Construct the initial tableau:

	f	x	y	z	S_1	S_2	Solution	
	0	1	1	1	1	0	2000	$\frac{2000}{1} = 2000$
	0	2	3	4	0	1	6000	$\frac{6000}{4} = 1500$
	1	-2	-2	-3	0	0	0	
R1 − R2	0	$\frac{1}{2}$ 1	$\frac{1}{4}$ $\frac{1}{2}$	0 correct 1	1	$-\frac{1}{4}$ $-\frac{1}{2}$	500 1000	$\frac{500}{0.5} = 1000$
R2	0	$\frac{1}{2}$	$\frac{3}{4}$	1	0	$\frac{1}{4}$	1500	$\frac{1500}{0.5} = 3000$
R3 + 3R2	1	$-\frac{1}{2}$	$\frac{1}{4}$	0	0	$\frac{3}{4}$	4500	all correct 1
R1	0	1	$\frac{1}{2}$	0	2 1	$-\frac{1}{2}$	1000	
R2 − ½R1	0	0	$\frac{1}{2}$	1	−1 $-\frac{1}{2}$	$\frac{1}{2}$	1000	all correct 1
R3 + ½R1	1	0 correct 1	$\frac{1}{2}$	0	1	$\frac{1}{2}$	5000	

Thus, the feasible solution is: $x = 1000$, $y = 0$, $z = 1000$, $S_1, S_2 = 0$
So the solution is: $x = 1000$, $y = 0$, $z = 1000$ 1 and the maximum value of the function f is RM 5000. 1

red pens answer is for the equation which not simplify.

10 a) let M = morning A = Afternoon N = Night.

http://edu.joshuatly.com/
http://www.joshuatly.com/

10. (b)

Day	Shift	No. of Item ~~produced~~ Y	~~Moving~~ Total	~~Moving~~ Average, T	Variation Y/T
Monday	Morning	27	-	-	-
	Afternoon	14	75	25	0.56
	Night	34	78	26	1.308
Tuesday	Morning	30	79	26.333	1.139
	Afternoon	15	83	27.667	0.542
	Night	38	81	27	1.407
Wednesday	Morning	28	83	27.667	1.012
	Afternoon	17	87	29	0.586
	Night	42	90	30	1.400
Thursday	Morning	31	89	29.667	1.045
	Afternoon	16	88	29.333	0.545
	Night	41	89	29.667	1.382
Friday	Morning	32	93	31	1.032
	Afternoon	20	96	32	0.625
	Night	44	-	-	-

2 2

M1
A1

	Day	Shift Morning	Afternoon	Night
	Monday	-	0.56	1.308
	Tuesday	1.139	0.542	1.407
	Wednesday	1.012	0.586	1.400,
	Thursday	1.045	0.545	1.382
	Friday	1.032	0.625	-
	Total	4.228	2.858	5.497
1	Average	1.057	0.572	1.374
M1	Correction factor	0.999	0.999	0.999
A1	Adjusted Seasonal Index	~~1.056~~ 1.06	0.571	~~1.373~~ 1.37

Total = 3.003

Correction factor = $\frac{3.000}{3.003}$ = 0.999

(c) Incremental production of one shift = $\frac{32-25}{12}$ = 0.583 1

Basic trend value for Monday morning of the second week (T_e)

= 32 + 0.583 (2) = 33.166 1

The estimated amount of production for Monday morning of the second week

= $T_e \times S$ = 33.166 × 1.056 = 35.02 = 35 units 1

NO: ...... DATE: ......

11.

Electronic goods	Price 2000 (p_0)	2001 (p_n)	Quantity 2000 (q_0)	2001 (q_n)
Standing fan	98	105	90	140
Table Lamp	45	50	62	80
Microwave	106	136	60	65

2 2

With 2000 as the base year,

Paasche price index for the year 1997

$$= \frac{\Sigma p_n q_n}{\Sigma p_0 q_n} \times 100 = \frac{105(140) + 50(80) + 136(65)}{98(140) + 45(80) + 106(65)} \times 100$$ 1

$$= \frac{27540}{24210} \times 100 = 113.75$$ 1

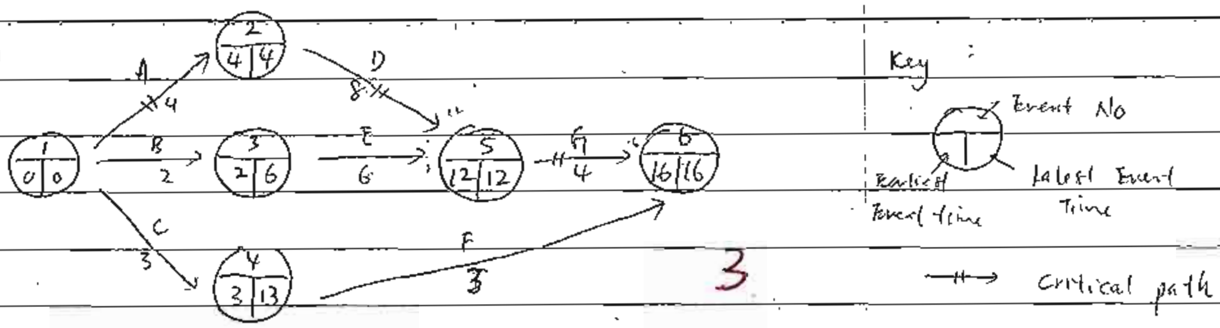
Laspeyres quantity index for the year 2001

$$= \frac{\Sigma q_n p_0}{\Sigma q_0 p_0} \times 100 = \frac{140(98) + 80(45) + 65(106)}{90(98) + 62(45) + 60(106)} \times 100$$ 1

$$= \frac{24210}{17970} \times 100 = 134.72$$ 1

The quantity (1) index is more significant to the business prospect than the price index. This is because the quantity index has increased 34.72% which is (1) more than 13.75%, the increase of price index.

12. (a)



3

(b) The critical path = A - D - G 1

The minimum duration for the project to be completed = 4 + 8 + 4 = 16 days. 1 1

(c)

Activity	Duration	EST	EFT	LST	LFT	Total float =
A	4	0	4	0	4	0
B	2	0	2	4	6	4.
C	3	0	3	10	13	10.
D	8	4	12	4	12	0.
E	6	2	8	6	12	4.
F	3	3	6	13	16	10.
G	4	12	16	12	16	0.

M 1
A 2

no need to show