Trial Examination 2010
Additional Mathematics Paper 2
QUESTIONS AND MARKING SCHEME
Section A
Answer **all** questions in this section
[40 marks]

1. Solve the simultaneous equations:
$2x+9y=3$ and $xy+y+2=0$

$2x+9y=3$

$x=\frac{3-9y}{2}$ let it be eq. 1

sub. eq.1 into $xy+y+2=0$

$\left(\frac{3-9y}{2}\right)y+y+2=0$ ← 1

$3y-9y^2+2y+4=0$

$9y^2-5y-4=0$

$(9y+4)(y-1)=0$ ← 1

$y=-\frac{4}{9}$ or $y=1$ ← 1

Sub. $y=-\frac{4}{9}$ into eq. 1

$x=\frac{3-9\left(-\frac{4}{9}\right)}{2}=\frac{3+4}{2}$

$x=\frac{7}{2}$

Sub. $y=1$ into eq. 1

$x=\frac{3-9(1)}{2}=\frac{3-9}{2}$

$x=-3$ ← 1 Both correct

$x=\frac{7}{2}, y=-\frac{4}{9}$ or $x=-3, y=1$ Accept: $\left(\frac{7}{2},-\frac{4}{9}\right)$ or $(-3,1)$

← 1 Both correct

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2. Given the function $f(x)=\frac{10-9x}{x}, x\neq k$

a) Deduce the value of k

b) Find each of the following functions

i) $f^{-1}(x)$

ii) $f^{2}(x)$

c) Find the values of x when $f^{2}(x)=f^{-1}(x)$

a)

$k=0$ ← 1

b)

let $y=\frac{10-9x}{x}$ ← 1

$xy=10-9x$

$xy+9x=10$ ← 1

$x(y+9)=10$

$x=\frac{10}{y+9}$

$f^{-1}(x)=\frac{10}{x+9}; x\neq -9$ ← 1

ii)

$f^{2}(x)=f\left(\frac{10-9x}{x}\right)$

$f\left(\frac{10-9x}{x}\right)=\frac{10-9\left(\frac{10-9x}{x}\right)}{\frac{10-9x}{x}}$

$f\left(\frac{10-9x}{x}\right)=\frac{10x-90+81x}{10-9x}$

$f^{2}(x)=\frac{91x-90}{10-9x}; x\neq \frac{10}{9}$ ← 1

c)

$\frac{91x-90}{10-9x}=\frac{10}{x+9}$

$(91x-90)(x+9)=100-90x$

$91x^2+819x-90x-810=100-90x$

$91x^2+819x-910=0$ ← 1

divide all by 91

$x^2+9x-10=0$

$(x-1)(x+10)=0$

$x=1$ or $x=-10$ ← 1

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3. Without the use of a calculator or tables,

a) show that $\sin(30^\circ + x) + \sin\left(30^\circ - x\right) = \cos x$

b) Solve the equation $2\sin\left(30^\circ + x\right) + 2\sin\left(30^\circ - x\right) = \sqrt{3}\cot x$ for $0^\circ \le x \le 180^\circ$

a)

$\sin(30^\circ + x) + \sin\left(30^\circ - x\right) = \sin 30 \cos x + \cos 30 \sin x + \sin 30 \cos x - \cos 30 \sin x$ ← 1

$\frac{1}{2}\cos x + \frac{\sqrt{3}}{2}\sin x + \frac{1}{2}\cos x - \frac{\sqrt{3}}{2}\sin x$ ← 1

$\cos x$ .... shown

b)

$2\sin\left(30^\circ + x\right) + 2\sin\left(30^\circ - x\right) = \sqrt{3}\cot x$

$2\left\{\sin\left(30^\circ + x\right) + \text{in}\left(30^\circ - x\right)\right\} = \sqrt{3}\cot x$ ← 1 Know how to factorize

From the above (a); $\sin\left(30^\circ + x\right) + \text{in}\left(30^\circ - x\right) = \cos x$

$2\cos x = \sqrt{3}\cot x$

$2\cos x = \sqrt{3}\left(\frac{\cos x}{\sin x}\right)$ or $2\cos x \sin x - \sqrt{3}\cos x = 0$ ← 1

$\cos x\left(2\sin x - \sqrt{3}\right) = 0; \sin x = \frac{\sqrt{3}}{2}$ or $\cos x = 0$

6

$x = 60^\circ, 90^\circ, 120^\circ$ ← 2 All three answers 2 marks, 2 answers 1 mark

4. a) A set of data ***X***, which consists of 7 numbers, is defined by $\sum x = 28$ and $\sum x^2 = 210$. Calculate the mean and variance of the 7 numbers.

b) Two numbers 6 and k are added to the 7 numbers in (a) to form a set of data ***Y***, which consists of 9 numbers. If the mean of the set of data ***Y*** remains the same as the mean of the set of data ***X***, find

i) the value of k

ii) the standard deviation of the set of data ***Y***.

a)

$\sum x = 28$ and $\sum x^2 = 210$

$\bar{x} = \frac{\sum x}{7} = \frac{28}{7}$

$\bar{x} = 4$ ← 1

Variance $= \frac{\sum x^2}{N} - (\bar{x})^2$

Variance $= \frac{210}{7} - 16$

Variance $= 30 - 16$

Variance $= 14$ ← 1

b)

$\bar{x} = \frac{28 + 6 + k}{7 + 2}$ ← 1

$\bar{x} = \frac{34 + k}{9} = 4$

$34 + k = 36$

$k = 2$ ← 1

Standard deviation $= \sqrt{\frac{\sum x^2 + 6^2 + 2^2}{N} - (\bar{x})^2}$

Standard deviation $= \sqrt{\frac{210 + 36 + 4}{9} - 16}$ ← 1

Standard deviation $= \sqrt{\frac{250}{9} - 16} = \sqrt{11.7777}$

Standard deviation $= 3.4319$ ← 1

6

5. a) Find the equation of the normal to the curve $y = 2x + \frac{6}{x}, x \neq 0$ at the point (2, 7)

b) If this normal meets the curve again at *S*, find the coordinates of *S*.

$y = 2x + \frac{6}{x}, x \neq 0$

$y = 2x + 6x^{-1}$

$\frac{dy}{dx} = 2 - 6x^{-2}$ ← 1

at $(2, 7)$

$m_t = 2 - \frac{6}{4} = 2 - \frac{3}{2}$

$m_t = \frac{1}{2}$ ← 1

$\therefore m_{normal} = -2$ ← 1

Equation of normal at $(2, 7)$

$y - 7 = -2(x - 2)$ ← 1

$y - 7 = -2x + 4$

$y = -2x + 11$ ← 1

$y = 2x + \frac{6}{x}$ ---- eq 1

$y = -2x + 11$ ---- eq 2

$eq1 = eq2$

$2x + \frac{6}{x} = -2x + 11$

$2x^2 + 6 = -2x^2 + 11x$ ← 1

$4x^2 - 11x + 6 = 0$

$(4x - 3)(x - 2) = 0$

$x = \frac{3}{4}$ or $x = 2$ ← 1 Both

For $x = \frac{3}{4}, y = -2\left(\frac{3}{4}\right) + 11$

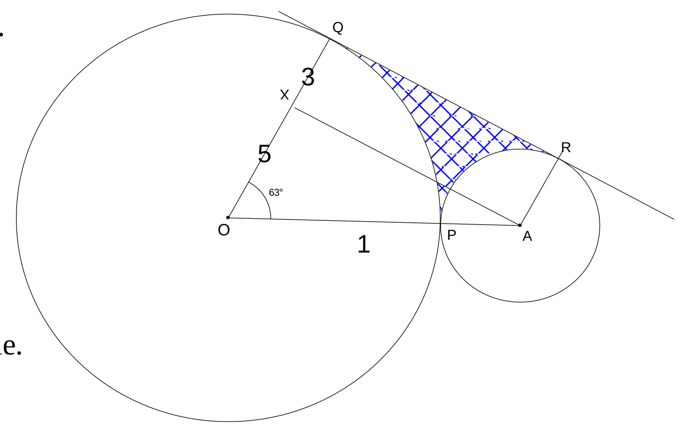
$y = \frac{-3}{2} + 11 = 9.5$

$S(0.75, 9.5)$ ← 1

8

6.
Diagram 1 shows two circles with centre *O* and *A*. The respective radii are 8 *cm* and 3 *cm*. A tangent touches the circles at *Q* and *R*.
Given that $\angle QOP = 62.9^\circ$, find

a) the length of *QR*
b) the perimeter of the shaded region
c) the area of the shaded region.



From the diagram, Δ *OXA* is a right-angled triangle.

thus, $XA = \sqrt{AO^2 - OX^2}$

$AX = \sqrt{121 - 25}$ ← 1

$AX = \sqrt{96} = 9.7979$ cm

$QR = 9.798\ cm$ ← 1

Similarly, $\angle \cos XOA = \frac{5}{11}$

$\angle XOA = 62.9^\circ$

b)

The perimeter of shaded region

Perimeter = $QR + 8(1.0997) + 3(2.0423)$ ← 1

Perimeter $= 9.7979 + 8.7976 + 6.1269$

Perimeter $= 24.7224\ cm$ ← 1

c)

Area of shaded region = *OQRA* – Area of sector *QOP* – Area of sector *RAP*

Area $= \frac{1}{2}(8+3)9.7979 - \frac{1}{2}(64)1.0997 - \frac{1}{2}(9)2.0423$ ← 3 (1 mark **for each** correct formula used)

Area $= 53.8885 - 35.1904 - 9.1904$

Area $= 9.5077\ cm^2$ ← 1

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Section B
Answer **four** questions in this section
[**40 marks**]

7. Use a piece of graph paper to answer this question.
Variables x and y are related by the equation, $y^n = a(3^x)$ where a and n are constants.
Table 1 shows the values of x and y obtained from an experiment.

x	0	1	2	3	4	5
y	1.73	3.01	5.20	8.98	15.59	27.20

Table 1

a) Using a scale of 2 *cm* to 0.50 *units* on the horizontal and 2 *cm* to 0.10 *units* on the vertical axis. Plot lg y against x [4 marks]

b) Use your graph from (a) to find
   i) the value of a and of n, [4 marks]
   ii) the value of y when x = 2.30 [2 marks]

$y^n = a(3^x)$

$n\lg y = \lg a + x\lg 3$ ← 1

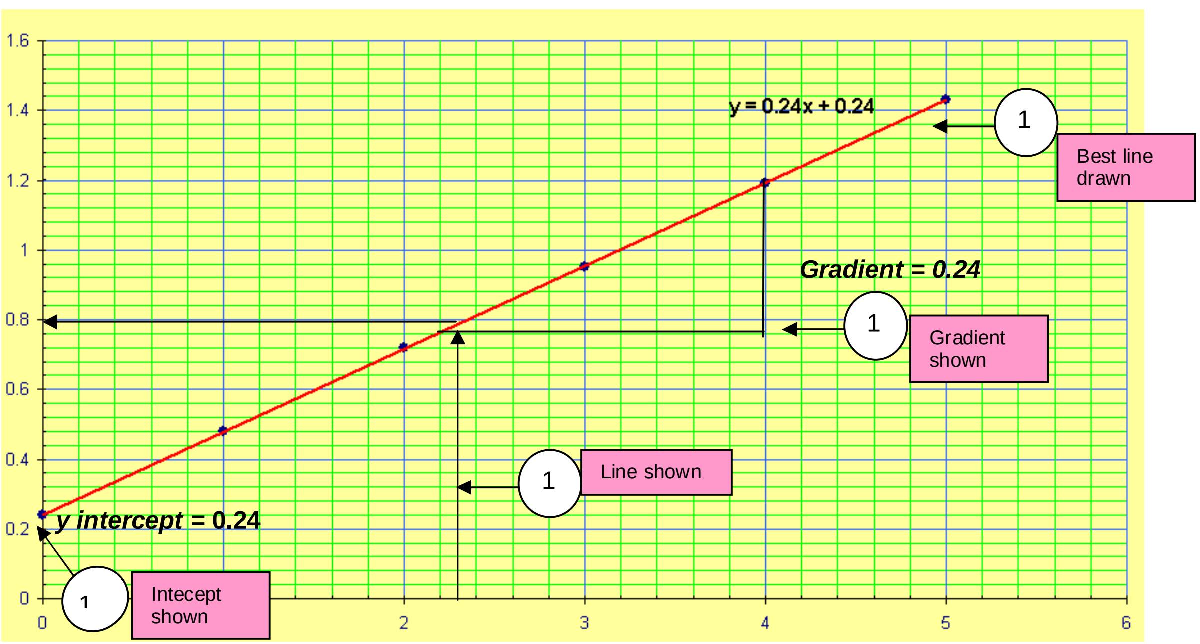
$n\lg y = \lg 3(x) + \lg a$

$n\lg y = 0.47712x + \lg a$

$\lg y = \left(\frac{0.47712}{n}\right)x + \frac{1}{n}\lg a$ ← 1

1

x	0	1	2	3	4	5
y	1.73	3.01	5.20	8.98	15.59	27.20
$lg\ y$	0.24	0.48	0.72	0.95	1.19	1.43



From the graph, $\left(\frac{0.47712}{n}\right) = 0.24$

$n = 1.99$ ← 1

and that $\frac{1}{n}\lg a = 0.24$

$\frac{1}{1.99}\lg a = 0.24$

$\lg a = 0.4776$

$a = 3.003$ ← 1

b) ii) when x = 2.3 lg y = 0.792
Thus, y = 6.19 ← 1

8. a) It is given that the position vectors, relative to the origin O, of P, Q, and R are $\begin{pmatrix}1\\14\end{pmatrix}$, $\begin{pmatrix}3\\12\end{pmatrix}$ and $\begin{pmatrix}7\\8\end{pmatrix}$ respectively.

i) Find the vectors $\overrightarrow{PQ}$ and $\overrightarrow{QR}$

ii) Hence, show that P, Q, and R are collinear and find the ratio $PQ: QR$.

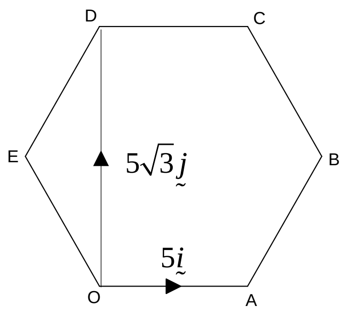


Diagram 2

b) ***Diagram 2*** shows a regular hexagon OABCDE, where $\overrightarrow{OA} = 5\underset{\sim}{i}$ and $\overrightarrow{OD} = 5\sqrt{3}\underset{\sim}{j}$

Find, in terms of $\underset{\sim}{i}$ and $\underset{\sim}{j}$, the vectors $\overrightarrow{AD}$, $\overrightarrow{OE}$ and $\overrightarrow{EC}$

Given that

$\overrightarrow{OP} = \begin{pmatrix}1\\14\end{pmatrix}, \overrightarrow{OQ} = \begin{pmatrix}3\\12\end{pmatrix}$ and $\overrightarrow{OR} = \begin{pmatrix}7\\8\end{pmatrix}$

$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ}$

$\overrightarrow{PQ} = \begin{pmatrix}-1\\-14\end{pmatrix} + \begin{pmatrix}3\\12\end{pmatrix}$ ← (1)

$\overrightarrow{PQ} = \begin{pmatrix}2\\-2\end{pmatrix}$ ← (1)

$\overrightarrow{QR} = \overrightarrow{QO} + \overrightarrow{OR}$

$\overrightarrow{QR} = \begin{pmatrix}-3\\-12\end{pmatrix} + \begin{pmatrix}7\\8\end{pmatrix}$ ← (1)

$\overrightarrow{QR} = \begin{pmatrix}4\\-4\end{pmatrix}$ ← (1)

$\overrightarrow{PQ} = k\overrightarrow{QR}$

$\overrightarrow{PQ} = 2i - 2j$ while $\overrightarrow{QR} = 4i - 4j$

$2i - 2j = 2k(2i - 2j)$

$1 = 2k$

$k = 0.5$

Therefore, PQR are collinear ← (1)

Hence the ratio is $1:2$

Both

b)

$\overrightarrow{OA} = 5\underset{\sim}{i}$ and $\overrightarrow{OD} = 5\sqrt{3}\underset{\sim}{j}$

$\overrightarrow{AD} = \overrightarrow{AO} + \overrightarrow{OD}$

$\overrightarrow{AD} = -5i + 5\sqrt{3}j$ ← (1)

$\overrightarrow{OE} = \frac{1}{2}\overrightarrow{AD}$ ← (1)

$\overrightarrow{OE} = \frac{1}{2}\left(-5i + 5\sqrt{3}j\right)$ ← (1)

$\overrightarrow{EC} = \overrightarrow{ED} + \overrightarrow{DC}$

$\overrightarrow{EC} = \overrightarrow{EO} + \overrightarrow{OD} + \overrightarrow{OA}$

$\overrightarrow{EC} = \frac{5}{2}i - \frac{5\sqrt{3}}{2}j + 5\sqrt{3}j + 5i$ ← (1)

$\overrightarrow{EC} = \frac{15}{2}i + \frac{5\sqrt{3}}{2}j$

$\overrightarrow{EC} = \frac{5}{2}\left(3i + \sqrt{3}j\right)$ ← (1)

9. ***Diagram 3*** shows that straight line $y = 2x + 10$ is perpendicular to *ST*. *Q* is the intersection point of the lines such that *SQ: QT* = 1: 2.

Find

a) the equation of *ST*,

b) the coordinates of *Q*

c) the coordinates of *S*

d) the area of the quadrilateral *OPQR*.

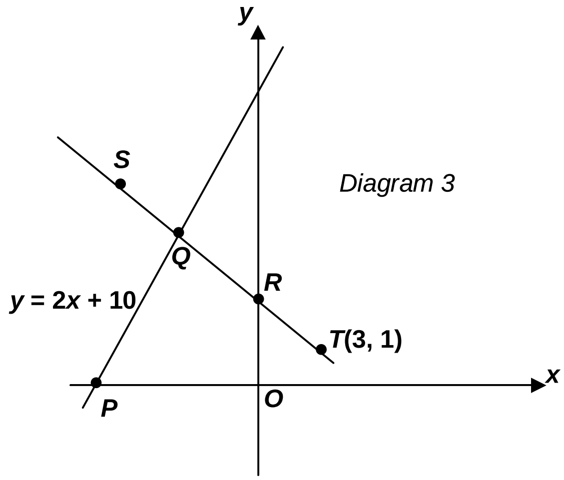


Diagram 3

a)

$y = 2x + 10$

$m = 2$

Gradient of $ST = -\frac{1}{2}$ ← (1)

Equation of ST with point $T(3,1)$

$y - 1 = -\frac{1}{2}(x - 3)$ ← (1)

$2y - 2 = -x + 3$

$2y + x = 5$ ← (1)

b)

$y = 2x + 10 --- eq1$

$2y + x = 5 --- eq2$

Sub. eq1 into eq2

$2(2x + 10) + x = 5$ ← (1)

$4x + 20 + x = 5$

$5x = -15$

$x = -3$

Sub. $x = -3$ into eq. 1

$y = -6 + 10$

$y = 4$

$Q(-3, 4)$ ← (1)

c)

$SQ : QT = 1 : 2$

Let $S(x, y); T(3,1)$ where $m = 1$ and $n = 2$

$Q = \left(\frac{2x+3}{3}, \frac{2y+1}{3}\right)$ ← (1)

Since we know that $Q(-3, 4)$

$\frac{2x+3}{3} = -3$ and $\frac{2y+1}{3} = 4$

$2x + 3 = -9$ $\quad$ $2y + 1 = 12$

$x = -6$ $\quad$ $y = 5.5$ ← (1) Both

$S\left(-6, \frac{11}{2}\right)$ ← (1)

d)

Coordinate of $P(-5, 0)$ and $R(0, \frac{5}{2})$

Area of $OPQR = \frac{1}{2}\begin{vmatrix} 0 & -5 & -3 & 0 & 0 \\ 0 & 0 & 4 & \frac{5}{2} & 0 \end{vmatrix}$ ← (1)

Area $= \frac{1}{2}\left|\left(-20 - \frac{15}{2}\right) - (0)\right|$

Area $= \frac{1}{2}\left|\frac{-55}{2}\right|$

Area $= \frac{1}{2}\left(\frac{55}{2}\right)$ ← (1)

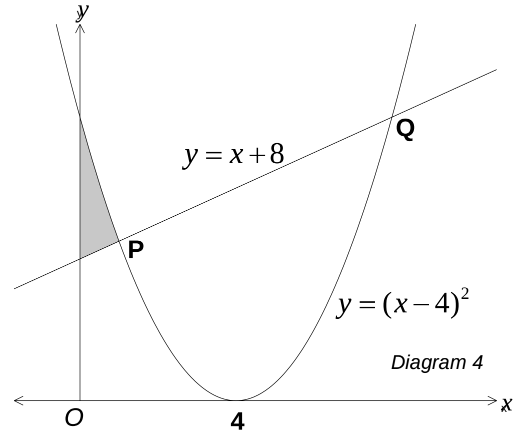
Area $= \frac{55}{4}$ or 13.75 units^2

10. ***Diagram 4*** shows a straight line $y = x + 8$ and a curve $y=(x-4)^2$.

P and Q are the intersection points of the straight line and the curve. Find

a) the coordinates of P and Q

b) the shaded area enclosed by the straight line $y = x + 8$ and curve $y=(x-4)^2$



a)

$y=x+8$

$y=(x-4)^2$

$x+8=(x-4)^2$ ← 1

$x+8=x^2-8x+16$

$x^2-9x+8=0$

$(x-1)(x-8)=0$ ← 1

$x=1$ or $x=8$

For $x=1$ For $x=8$ ← 1 Both

$y=9$ $y=16$

$P(1,9)$ and $Q(8,16)$ ← 1, 1

b) Limits correct 1

Area of shaded region $=\int_0^1\{(x-4)^2-(x+8)\}dx$ ← 1

Area of shaded region $=\int_0^1\{x^2-8x+16-x-8\}dx$

Area of shaded region $=\int_0^1\{x^2-9x+8\}dx$ ← 1

Area $=\left|\frac{x^3}{3}-\frac{9x^2}{2}+8x\right|_0^1$ ← 1

Area $=\left|\left(\frac{1}{3}-\frac{9}{2}+8\right)-0\right|$

Area $=\frac{2-27+48}{6}$

Area $=3.8333...$ unit^2 ← 1

11. a) The probability of an adult at the age of forty suffered from short-sightedness is 0.25. Five forty years old are under going an eye test. Find the probability that

i) exactly 2 adults.

ii) at least one adult,

suffered from short-sightedness.

b) The marks obtained by 4000 students in a Mathematics test are found to be distributed normally with a mean of 54 and a standard deviation of 12 marks.

i) If the minimum mark for grade A is 75, find the number of students who obtained grade A.

ii) If 20% of the students failed the test, determine the minimum passing mark.

a)

$p = 0.25$ and $q = 0.75$

$P(x)={}^5C_2p^2q^3$ ← 1

$P(x)=(10)(0.25)^2(0.75)^3$ ← 1

$P(x)=10\times0.0625\times0.421875$

$P(x)=0.26367$ ← 1

$P(0)+P(1)+P(2)+P(3)+P(4)+P(5)=1$

At least 1 means; $1-P(0)$

$1-P(0)=1-{}^5C_0p^0q^5$ ← 1

$1-P(0)=1-(1)(0.25)^0(0.75)^5$

$1-P(0)=1-(1)(0.75)^5$ ← 1

$1-P(0)=1-0.23730$

$P(\geq 0)=0.7627$ ← 1

b)

$\mu = 54; \sigma = 12$ and $n = 4000$

$N(x > 75) = Z\left(z > \dfrac{75-54}{12}\right)$

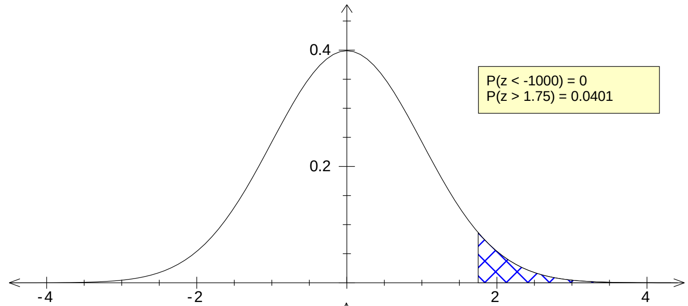
$z > 1.75$ ← 1

$P(z.1.75) = 0.0401$

$0.0401 = \dfrac{n(\text{students getting } \geq 75)}{4000}$

$n(\text{students getting } \geq 75) = 160.4$

$n(\text{students getting } \geq 75) = 160$ students ← 1



c)

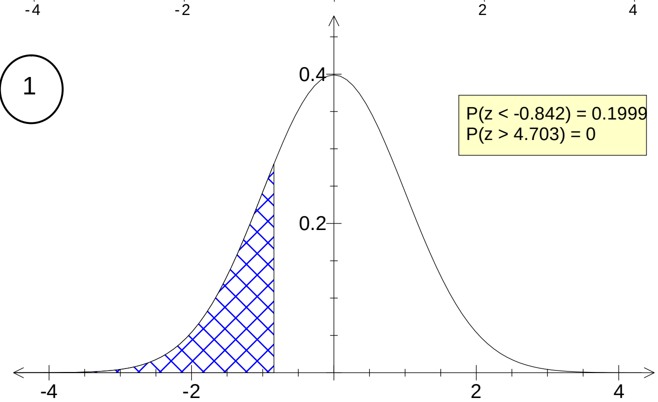
$P\ (Z \leq z) = 0.2$

$z = -0.842$

$-0.842 \ = \dfrac{x-54}{12}$ ← 1

$x = 43.896$

The minimum passing marks 44 ← 1



Section C

Answer **two** questions from this section

[**20 marks**]

12. A particle moves in a straight line such that t seconds after passing through a fixed point O with a velocity 8 m/s, its acceleration, a m/s^2 is given by $a = 2t - 6$ [Assume motion to the right is positive]

a) Express, in terms of t, the velocity of v m/s of the particle.

b) Find the time intervals when the particle moves to the right.

c) Sketch the velocity-time graph of the motion of the particle for the time interval $0 \leq t \leq 5$.

d) Hence, or otherwise, calculate the total distance moved by the particle during the first 5 seconds after passing through O

a)

$a = 2t - 6$

$\dfrac{dv}{dt} = 2t - 6$

$v = \dfrac{2t^2}{2} - 6t + c$

Stated that when $t = 0, v = 8$

$8 = c$

$v = t^2 - 6t + 8$ ← 1

b)

$v = t^2 - 6t + 8$

If particle moves to the right, $v > 0$

Thus, $t^2 - 6t + 8 > 0$

$(t-2)(t-4) > 0$

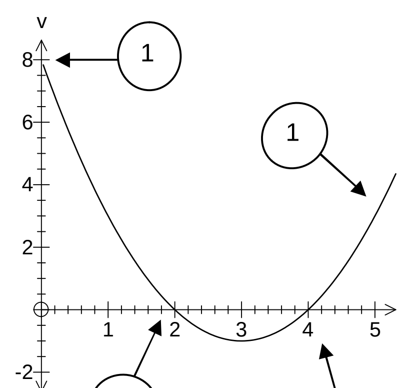
$t < 2$ or $t > 4$

$0 \leq t < 2$ or $t > 4$ ← 1

c)

t	0	1	2	3	4	5
v	8	3	0	-1	0	3

← 1



d) $\dfrac{ds}{dt} = t^2 - 6t + 8$

$s = \dfrac{t^3}{3} - \dfrac{6t^2}{2} + 8t + c$, when $t = 0, s = 0 \therefore c = 0$

$s = \dfrac{t^3}{3} - 3t^2 + 8t$. When $t = 2$ ← 1

$s = \dfrac{8}{3} - 12 + 16 = 6.6667m$ 1

$\therefore$ Total distance travelled

$6.6667 + 1.333 + 1.333 = 9.333\ m$ ← 1

13. ***Diagram 5*** shows a quadrilateral *ABCD*.

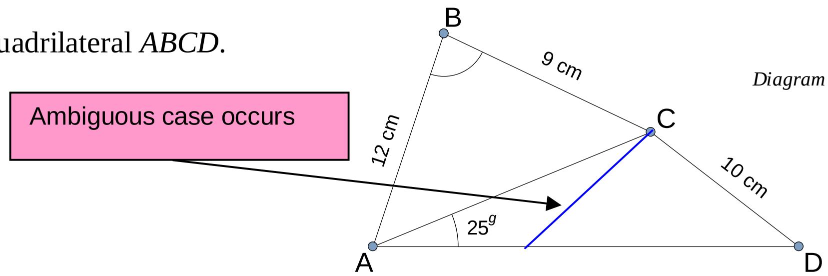


Diagram 5

Given *AB* = 12 cm, *BC* = 9 cm, *CD* = 10 cm, and $\angle ABC = \theta$, where $\angle ABC$ is an obtuse angle. The area of triangle *ABC* is 27 cm^2.

a) Calculate the value of θ.

b) Find the length, in cm of

i) *AC*

ii) *AD*,

c) Calculate the area of the quadrilateral *ABCD*.

a)

$$\text{Area of } \Delta\ ABC = \frac{1}{2}(12)(9)\sin\theta$$ (1)

$$54\sin\theta = 27$$

$$\sin\theta = 0.5$$

$$\theta = 30^\circ$$

Since stated that θ is obtuse,

$$\theta = 150^\circ$$ (1)

b)

$$AC^2 = 12^2 + 9^2 - 2(12)(9)\cos 150^\circ$$ (1)

$$AC^2 = 144 + 81 - 216\cos 150^\circ$$

$$AC^2 = 225 + 187.06148$$

$$AC^2 = 412.06148$$

$$AC = 20.2993\ cm$$ (1)

c)

Using sine rule:

$$\frac{\sin 25}{10} = \frac{\sin D}{20.2993}$$ (1)

$$\sin D = \frac{20.2993(\sin 25)}{10}$$

$$\sin D = 0.85788$$

$$\angle D = 59.08^\circ$$ (1)

Angle C can now be found: $180 - 25 - 59.08 = 95.92^\circ$

$$\frac{AD}{\sin 95.92} = \frac{10}{\sin 25}$$ (1)

$$AD = \frac{10(\sin 95.92)}{\sin 25}$$

$$AD = 23.5358\ cm$$ (1)

Using sine rule:

$$\frac{\sin 25}{10} = \frac{\sin D}{20.2993}$$

$$\sin D = \frac{20.2993(\sin 25)}{10}$$

$$\sin D = 0.85788$$

$$\angle D = 120.92^\circ$$

Angle C can now be found: $180 - 25 - 120.92 = 34.08^\circ$

$$\frac{AD}{\sin 34.08} = \frac{10}{\sin 25}$$

$$AD = \frac{10(\sin 34.08)}{\sin 25}$$

$$AD = 13.259\ cm$$

d)

Area of *ABCD* = Area of *ABC* + Area of *ACD*

$$\text{Area of } ABCD = 27 + \frac{1}{2}(20.2993)(10)\sin 95.92$$ (1)

$$\text{Area of } ABCD = 27 + 100.9552$$

$$\text{Area of } ABCD = 127.9552\ cm^2$$ (1)

Area of *ABCD* = Area of *ABC* + Area of *ACD*

$$\text{Area of } ABCD = 27 + \frac{1}{2}(20.2993)(10)\sin 34.02$$

$$\text{Area of } ABCD = 27 + 56.8734$$

$$\text{Area of } ABCD = 83.8755\ cm^2$$

14. *Use a piece of graph paper to answer this question.*
A furniture shop produces two models of chairs **A** and **B**. The time taken to produce and cost of production of these models of chairs are given in **table 2** below:

Model of Chairs	Time of production per chair (hours)	Production cost per chair (RM)
A	2	30
B	1.6	25

The furniture shop produces x chairs of model **A** and y chairs of model **B** per day. The production of theses models by the worker per day is based on the following constrains:

I Maximum total hours utilized for making these chairs is 96 hours.
II The least total cost of production is RM 300
III The number of model **B** chairs produced exceeds the number of model **A** chairs by at least 5 chairs.

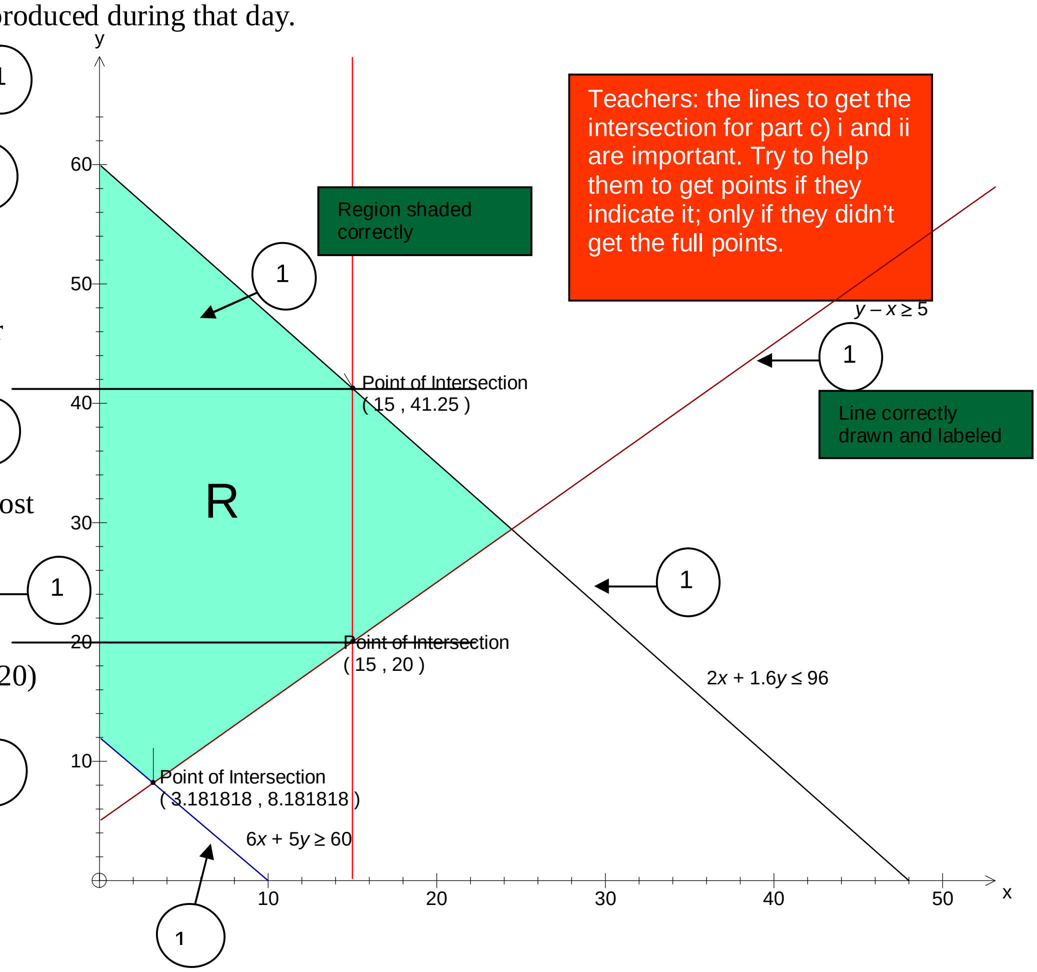
a) Write down three inequalities, other than $x \geq 0$ and $y \geq 0$, which satisfy all of the above constraints.
b) Using a scale of 2 cm to 5 chairs on both axes, construct and shade the region ***R***, which satisfies all of the above constraints.
c) By using your graph from 14(b), find
 i) the minimum number of model **B** chairs produced per day.
 ii) The maximum and minimum total costs for a particular day if 15 model **A** chairs are produced during that day.

a)
$2x + 1.6y \leq 96$ ← 1
$30x + 25y \geq 300$
$6x + 5y \geq 60$ ← 1
$y - x \geq 5$ ← 1

c)
From the graph,
i) the minimum number of model B chairs produced per day
9 chairs ← 1

ii) the maximum total cost is 30(15) + 25(41)
450 + 1025 = 1475 ← 1

The minimum total Cost is 30(15) + 25(20)
450 + 500 = 950 ← 1



15. ***Table 3*** shows the price indices of four items P, Q, R and S for the year 2007 based on the year 2003 and the percentage rise / fall in the price indices of these four items from the year 2005 to the year 2007.

Items	Price index for the year 2007 based on the year 2003	Percentage rise / fall I price index for the year 2005 based on the year 2003
P	160	+ 10%
Q	184	+ x%
R	120	–10%
S	y	+15%

The price indices of items Q and S for the year 2007 based on the year 2005 are 125 and 130 respectively.

a) Find the value of x and of y

b) Calculate the price index for the year 2007 based on the year 2005 for

i) item P

ii) item R

c) Using the weightage **1: 3: 4: 2** for the items P, Q, R and S respectively, calculate the composite index number of these items for the year 2007 based on the year 2003.

Q

$$\frac{P_{07}}{P_{05}}=\frac{125}{100} \text{ and } \frac{P_{07}}{P_{03}}=\frac{184}{100}$$

$$\frac{P_{05}}{P_{03}}=\frac{100+x}{100}$$ ← 1

$$\frac{100}{125}\times\frac{184}{100}=\frac{100+x}{100}$$

$$18400=12500+125x$$

$$x=47.2$$ ← 1

S

$$\frac{P_{07}}{P_{05}}=\frac{130}{100} \text{ and } \frac{P_{07}}{P_{03}}=\frac{y}{100}$$

$$\frac{P_{05}}{P_{03}}=\frac{115}{100}$$

$$\frac{130}{100}\times\frac{115}{100}=\frac{y}{100}$$ ← 1

$$14950=100y$$

$$y=149.5$$ ← 1

P

$$\frac{P_{07}}{P_{03}}=\frac{160}{100} \text{ and } \frac{P_{05}}{P_{03}}=\frac{110}{100}$$ ← 1

$$\frac{P_{07}}{P_{05}}\times 100=\frac{160}{100}\times\frac{100}{110}\times 100$$

$$I_{07}=145.45$$ ← 1

R

$$\frac{P_{07}}{P_{03}}=\frac{120}{100} \text{ and } \frac{P_{05}}{P_{03}}=\frac{90}{100}$$ ← 1

$$\frac{P_{07}}{P_{05}}\times 100=\frac{120}{100}\times\frac{100}{90}\times 100$$

$$I_{07}=133.3...$$ ← 1

c)

I	***w***	***Iw***
160	1	160
184	3	552
120	4	480
149.5	2	299
	$\sum I=10$	$\sum Iw=1491$

$$\bar{I}=\frac{\sum Iw}{\sum w}=\frac{1491}{10}$$ ← 1

$$\bar{I}=149.1$$ ← 1

END OF MARKING SCHEME

DAVID CHNG YS PFS 19 August 2010