



YEARLY EXAMINATION

YEAR 10 2004

MATHEMATICS

Time Allowed – 120 minutes

(Plus 5 minutes reading time)

INSTRUCTIONS:

All questions may be attempted

Write your name at the top of each page

Answers to Multiple choice Questions 1-30 are to be entered onto the answer sheet provided

Answers to Questions 31-34 are to be returned in separate bundles

Department of Education approved calculators are permitted

Show all necessary working

Marks may not be awarded for untidy or carelessly arranged work

No grid paper is to be used unless provided with the examination paper

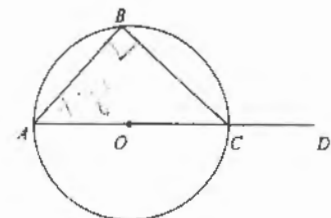
SECTION A (1 Mark Each)

Questions 1 – 27 have only one solution.

- When $x = 4$, then the value of $5x^2$ is
(A) 20 (B) 40 (C) 80 (D) 400
- $3^3 \times 3^4 =$
(A) 9^{12} (B) 3^7 (C) 9^7 (D) 3^{12}
- A photograph is 8 cm long and 6 cm wide. It is enlarged so that the new length is 10 cm. The new width is
(A) 7.5 cm (B) 8 cm (C) 8.5 cm (D) $13\frac{1}{3}$ cm

- In the diagram, AC is a diameter of the circle centre O and $\angle BAC = 38^\circ$. The size of $\angle BCD$ is

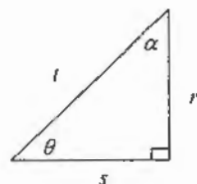
- (A) 38° (B) 128°
(C) 138° (D) 52°



- What is the time 8 hours and 43 minutes after 10:28 am?
(A) 8:11 pm (B) 6:11 pm (C) 7:11 pm (D) 7:15 pm
- Expand and simplify $(2\sqrt{3} - 3\sqrt{5})^2$
(A) $57 - 6\sqrt{15}$ (B) $57 - 12\sqrt{15}$ (C) $-33 - 6\sqrt{15}$ (D) $-33 - 12\sqrt{15}$
- A cardboard box which measures 18 cm long by 12 cm wide by 7 cm high can hold 6 cylinders that are 7 cm high and have a base radius of 3 cm. If $\pi = \frac{22}{7}$, what is the volume of empty space left in the box?
(A) 1314 cm^3 (B) 1188 cm^3 (C) 324 cm^3 (D) 1116 cm^3
- In the numeral 9.731 the digit "9" has
(A) 300 times the value of the "3" (B) 30 times the value of the "3"
(C) 9 times the value of the "1" (D) 3 times the value of the "3"
- If a and b are both even, which of the following expressions gives an odd result?
(A) ab (B) $a + b$ (C) $(ab) \div 2$ (D) $(a + b) \div 2$

10. In the diagram, $\sin\theta$ is equivalent to

- (A) $\frac{t}{s}$ (B) $\frac{r}{s}$
 (C) $\frac{r}{t}$ (D) $\frac{s}{t}$



11. Which of the four lines P , Q , R and S in the diagram have positive slopes?

- (A) P only
 (B) R and S only
 (C) P , Q and R
 (D) P and Q only

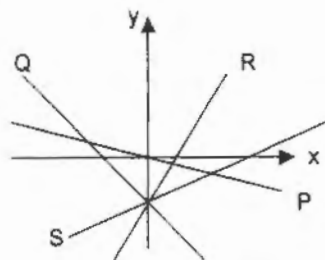
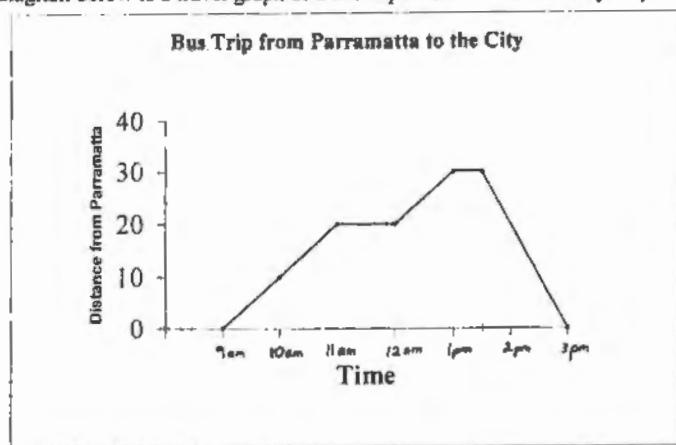


Diagram Not To Scale

12. Express 27225 as a product of its prime factors

- (A) $3^2 \times 5 \times 11^2$ (B) $3^3 \times 5^2 \times 11^2$ (C) $3^2 \times 5^2 \times 11^2$ (D) $3^2 \times 5^2 \times 11$

13. The diagram below is a travel graph of a bus trip from Parramatta to Sydney and return.



Which of the following statements is not a true interpretation of the graph?

- (A) The bus was not moving between 11 am and 12 noon.
 (B) The return trip was all downhill.
 (C) The bus stopped in Sydney for less than half an hour.
 (D) The average speed of the return trip to Parramatta was faster than the average speed of the trip to Sydney.

14. If $4 - 2x = \frac{x}{2} + 17$, then $x =$

- (A) $8\frac{2}{3}$ (B) $-2\frac{3}{5}$ (C) $-5\frac{1}{5}$ (D) $-8\frac{2}{3}$

15. Simplify $\left(\frac{2}{3}\right)^{-2} \times 27^{-\frac{1}{3}}$

- (A) $\frac{4}{3}$ (B) $\frac{3}{4}$ (C) 4 (D) $\frac{4}{9}$

16. The number 4047 rounded to 2 significant figures is

- (A) 4000 (B) 4100 (C) 4050 (D) 4040

17. A quadrilateral has a pair of opposite sides equal and parallel. The diagonals must

- (A) be equal (B) bisect each other
 (C) bisect the angles of the quadrilateral (D) be perpendicular to each other

18. Given that $S_n = \frac{n}{2}\{2a + (n-1)d\}$ and $S_n = 156$, $n = 41$, $a = 13$ then d correct to one decimal place is

- (A) 0.5 (B) 0.7 (C) -0.4 (D) -0.5

19. The mean mass of 1000 students is 62.0 kg with a standard deviation of 5.8 kg. From this approximately $\frac{2}{3}$ of the students would have a mass between

- (A) $62.0 \text{ kg} \pm \frac{1}{3}$ of 5.8 kg (C) $62.0 \text{ kg} \pm \frac{1}{2}$ of 5.8 kg
 (B) $62.0 \text{ kg} \pm \frac{2}{3}$ of 5.8 kg (D) $62.0 \text{ kg} \pm 5.8 \text{ kg}$

20. If O is the centre of the circle, then the value of x is equal to

- (A) 10 (B) 20
 (C) 40 (D) 60

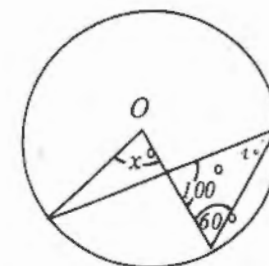


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21. A standard pack of 52 cards is shuffled. A card is drawn out and kept, and then a second card is drawn. What is the probability that the second card is black if it is known that the first card is black?

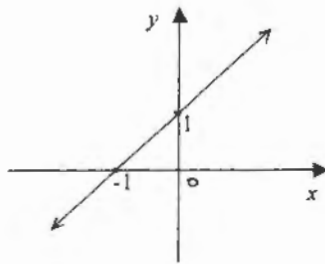
- (A) $\frac{1}{2}$ (B) $\frac{25}{102}$ (C) $\frac{25}{52}$ (D) $\frac{25}{51}$

22. Joe buys a \$4 500 T.V. on terms with 10% deposit and 24 equal monthly instalments of \$200. What is the simple interest rate per annum, correct to 1 decimal place?

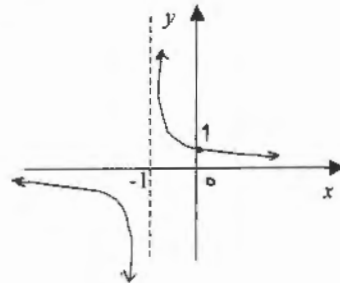
- (A) 8.3 (B) 9.9 (C) 8.8 (D) 9.4

23. Which graph best represents $yx + y = 1$? Diagrams are not to scale.

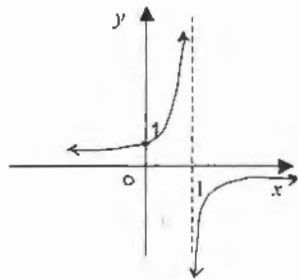
(A)



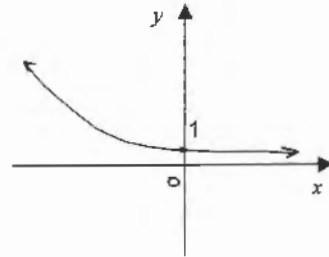
(B)



(C)



(D)



24. Using the diagram, x is equivalent to

- (A) $\frac{29 \sin 85^\circ}{\sin 50^\circ}$ (B) $\frac{29 \sin 85^\circ}{\sin 75^\circ}$
 (C) $\frac{29 \sin 60^\circ}{\sin 50^\circ}$ (D) $\frac{29 \sin 60^\circ}{\sin 75^\circ}$

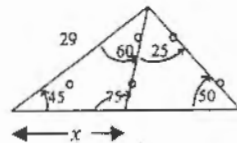


Diagram Not To Scale

25. For what value of x does the expression $(2x - 1)^2 + 3$ have its minimum value?

- (A) 0 (B) 1 (C) 0.5 (D) 3

26. A set of scores has a mean of 60 and a standard deviation of 10. If an extra score of 30 is added then

- (A) The mean will decrease and the standard deviation will increase.
 (B) The mean will increase and the standard deviation will decrease.
 (C) Both the mean and standard deviation will increase.
 (D) Both the mean and standard deviation will decrease.

27. In a class of 30 students, 5 study no languages at all, 9 study French, 14 study Japanese and 15 study Korean. If 5 students study French and Japanese, and 3 students study French and Korean, what is the probability that a student chosen at random studies all 3 languages?

- (A) $\frac{4}{15}$ (B) $\frac{8}{25}$ (C) $\frac{1}{15}$ (D) $\frac{2}{25}$

The following questions 28- 30 may have more than one answer.

28. Which of the polynomials represents a monic polynomial of degree 4?

- (A) $y = 4x(x + 1)^3$ (B) $y = (x + 1)^4$
 (C) $y = (x - 1)^2(x + 1)^2$ (D) $y = x(1 - x)(1 + x)(3 + x)$

29. Which of the following expressions has a value of -16 ?

- (A) $\frac{0.3^2 - 0.5^2}{0.1^2}$
 (B) $\frac{32768}{64 \times 32}$
 (C) the remainder when $P(x) = 2x^3 - x^2 + 4$ is divided by $(x + 2)$
 (D) the maximum value of $y = 10 + 16x - x^2$

30. The equation of a circle with centre $(1, -2)$ and radius 2 units can be written as

- (A) $(x + 1)^2 + (y - 2)^2 = 4$
 (B) $(x - 1)^2 + (y + 2)^2 = 4$
 (C) $x^2 - 2x + y^2 + 4y = -1$
 (D) $(x - 1)^2 + (y + 2)^2 = 2$

Section B Questions 31 – 34 are continued overleaf.

Section B Write your solutions on your own paper.

Question 31 (20 Marks)

Marks

- (a) Factorise fully
- (i) $a^3 - b^3 + 8a - 8b$ 3
- (ii) $2^{2x} - 1$ 1
- (b) Evaluate $\sqrt{2} \tan 60^\circ - \frac{\cos 30^\circ}{\sin 45^\circ}$. 3
- (c) If $3\sqrt{5} - \frac{1}{\sqrt{5}-2} = x + y\sqrt{5}$ find the values of x and y . 3
- (d) Two dice are rolled on a table and the product of the uppermost faces is recorded.
- (i) Draw a lattice diagram showing all possible outcomes. 2
- (ii) Find the probability that the number is a multiple of 10. 1
- (iii) Find the probability that the number is a multiple of 10, if it is known that at least one of the faces shows an even number. 2
- (e) Find the remainder when $P(x) = x^3 - 6x + 2$ is divided by $(x - 2)$. 2
- (f) Sam buys a computer system for \$1550. If the computer system depreciates at a rate of 15% per annum, calculate its value after 3 years, to the nearest 10 cents. 2
- (g) If it takes 10 men 3 hours to tile a floor of area, A square metres, how many men are needed to tile the same floor area in 2 hours? 1

Question 32 (20 Marks) Start a New Page.

Marks

- (a) (i) Solve $2x^2 - 26x + 72 = 0$. 2
- (ii) Hence, solve $x^2 - 13x + 36 < 0$. 1
- (b) If a car travels one kilometre at 30 km/hour and then another kilometre at 40 km/hour, what is its average speed for the 2 kilometres? 2
- (c) The points $A(-5, -1)$, $B(-1, 5)$ and $D(0, -3)$ are 3 vertices of a quadrilateral.
- (i) Write down the coordinates of the 4th vertex C , such that $ABCD$ is a parallelogram. 1
- (ii) Find the distance of BD . 2
- (iii) Find the equation of BD , in general form. 3
- (iv) Find the shortest distance from vertex C to the line BD . 2
- (v) Find the area of $ABCD$. 1
- (d) Draw a neat sketch of the graph $y = 2 - 2\sin x$ in the domain $-180^\circ \leq x \leq 90^\circ$. 4

- (e) Simplify fully $\frac{\sin X - 2\sin^3 X}{2\cos^3 X - \cos X}$. 2

Question 33 (20 Marks) Start a New Page.

Marks

- (a) ΔABC is drawn such that AB is 7 cm and AC is 9 cm. A line from B is drawn to meet AC at D , such that the ratio of $AD:DC$ is 4:5 and $BD = CD$.
- (i) On your answer sheet, draw a diagram using the above information. 1
- (ii) Use your diagram to find the cosine of $\angle ADB$ as a rational number. 2
- (iii) Find the area of ΔBCD , to 4 significant figures. 2
- (b) In the sketch below, a line $y = 4 - 6x$ cuts the parabola $y = f(x)$ at P .

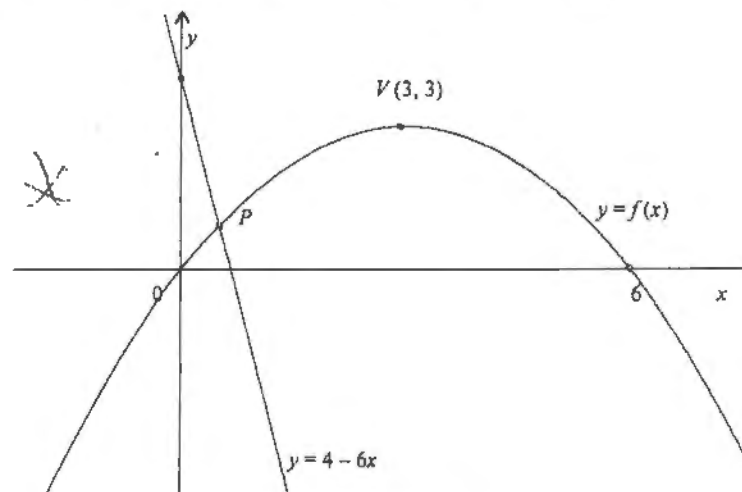


Diagram Not To Scale

- (i) Find the equation of the parabola $y = f(x)$. 2
- (ii) Find the coordinates of P . 3
- (c) A triangle ABC has area 1.7 km^2 . $AB = 750 \text{ m}$ and $AC = 4.8 \text{ km}$. Find the size of $\angle BAC$, to the nearest minute. 2
- (d) If a line connecting $A(2, -1)$ and $B(-3, x)$ makes an angle of 120° with the positive direction of the x -axis, find the value of x . 3
- (e) (i) Write the domain and range of $y = \sqrt{1-x}$. 2
- (ii) Does $y = \sqrt{1-x}$ define a function or relation? Explain clearly. 2
- (iii) Draw a sketch of $y = \sqrt{1-x}$ in its natural domain. 1

Question 34 (20 Marks) Start a New Page.

Marks

- (a) (i) Write $5\sin^2 A + \cos^2 A - 1$ in the form of $x + y \cos^2 A$. 2
 (ii) Hence or otherwise solve $5\sin^2 A + \cos^2 A - 1 = 0$. 2
 in the domain $0^\circ \leq A \leq 360^\circ$.
- (b) For the function $y = \frac{2x^2 - x - 3}{x - 4}$
- (i) Show by long division, that the remainder when $(2x^2 - x - 3)$ is divided 2
 by $(x - 4)$ is 25.
- (ii) Hence, rewrite the function as $y = (ax + b) + \frac{c}{x - 4}$. 1
- (iii) Draw a neat sketch of the function, showing all important 3
 features.
- (b) In the diagram, $AB \parallel DC$, $AD < BC$ and $DC : AB = k : 1$, where $k > 1$.

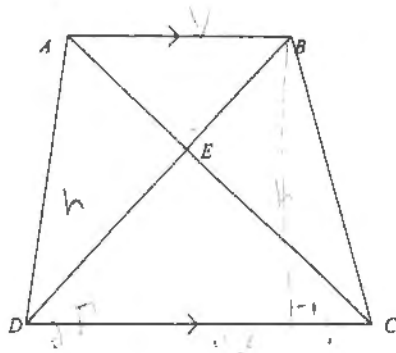


Diagram Not To Scale

- (i) Prove that $\triangle ABE \parallel \triangle DEC$. 3
 (ii) Hence, find the ratio of $AE : EC$, in terms of k , giving reasons. 2
 (iii) Hence, show that the ratio $(AD^2 - BC^2) : (DB^2 - AC^2) = k - 1 : k + 1$. 5

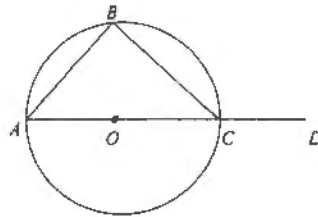
- END OF THE EXAMINATION -



SECTION A (1 Mark Each)

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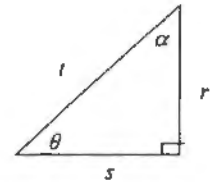
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- What is the time 8 hours and 43 minutes after 10:28 am?
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11. Which of the four lines P , Q , R and S in the diagram have positive slopes?

- (A) P only
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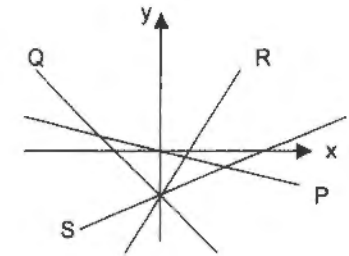
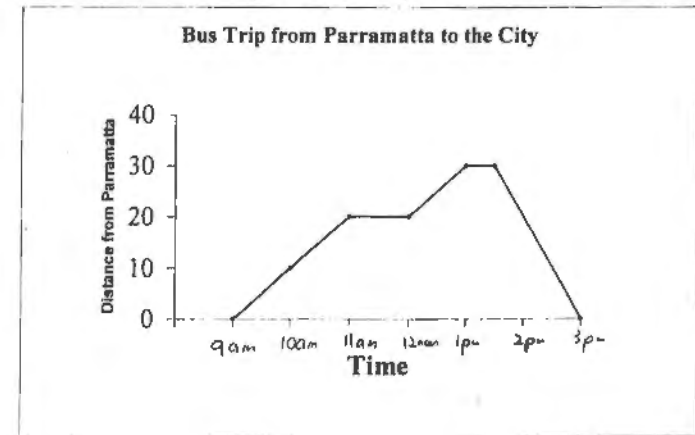


Diagram Not To Scale

12. Express 27225 as a product of its prime factors

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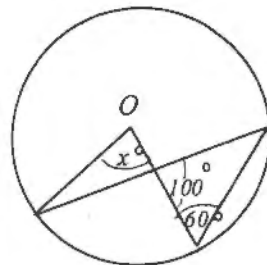


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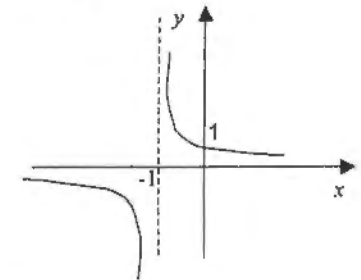
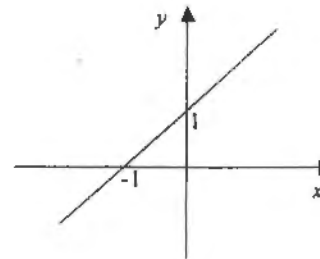
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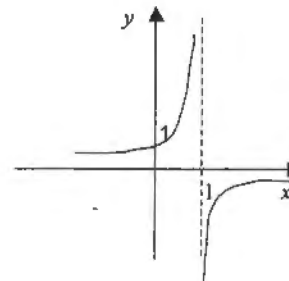
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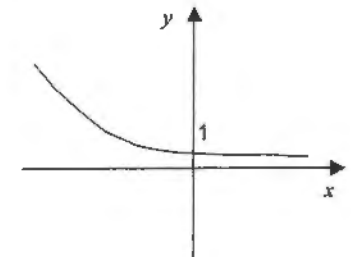
- (A) (B)



(C)



(D)



24. Using the diagram, x is equivalent to

- (A) $\frac{29 \sin 85^\circ}{\sin 50^\circ}$ (B) $\frac{29 \sin 85^\circ}{\sin 75^\circ}$
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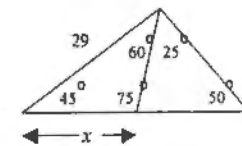


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29. Which of the following expressions has a value of -16 ?

(A) $\frac{0.3^2 - 0.5^2}{0.1^2}$

(B) $\frac{32768}{64 \times 32}$

- (C) The remainder when $P(x) = 2x^3 - x^2 + 4$ is divided by $(x+2)$.

- (D) The minimum value of $y = 10 + 16x - x^2$.

30. The equation of a circle with centre $(1, -2)$ and radius 2 units can be written as

- (A) $(x+1)^2 + (y-2)^2 = 4$
 (B) $(x-1)^2 + (y+2)^2 = 4$
 (C) $x^2 - 2x + y^2 + 4y = -1$
 (D) $(x-1)^2 + (y+2)^2 = 2$

Section B Questions 31 – 34 are continued overleaf.

Section B Suggested Marking scheme ONLY.

Question 31 (20 Marks)

- (a) (i) $a^3 - b^3 + 8a - 8b$
 $= (a-b)(a^2 + ab + b^2) + 8(a-b)$ → 2 mks
 $= (a-b)(a^2 + ab + b^2 + 8)$ → 1 mk
- (ii) $2^{2x} - 1 = (2^x - 1)(2^x + 1)$ → 1 mk

(b) $\sqrt{2} \tan 60^\circ - \frac{\cos 30^\circ}{\sin 45^\circ} = \sqrt{2} \times \sqrt{3} - \frac{\sqrt{3}}{2} \times \sqrt{2}$ → 2 mks
 $= \frac{\sqrt{6}}{2}$ → 1 mk

(c) $3\sqrt{5} - \frac{1}{\sqrt{5}-2} = x + y\sqrt{5}$
 LHS $= 3\sqrt{5} - \frac{1}{\sqrt{5}-2} \times \frac{\sqrt{5}+2}{\sqrt{5}+2}$ → 1 mk
 $= 3\sqrt{5} - \frac{\sqrt{5}+2}{1}$
 $= 2\sqrt{5} - 2$ → 1mk
 RHS $= x + y\sqrt{5}$ ∴ $x = -2$ & $y = 2$ → 1mk

- (d) (i) → 2mks

x	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

- (ii) $P(\text{multiple of } 10) = \frac{10}{36} = \frac{1}{6}$ → 1mk

- (iii) $P(\text{Multiple of } 10 | \text{at least one even}) = \frac{6}{27} = \frac{2}{9}$ → 2mks

(e) $P(2) = (2)^5 - 6(2) + 2 = -2$ → 1mk

(f) $1550 \times (0.85)^3 = 951.90$ → 2mks

∴ Value after 3 years is \$951.90

(g)

Using $T = \frac{kA}{N}$,

$\therefore 3 = \frac{kA}{10}$ i.e. $kA = 30$

$\therefore 2 = 30 \div N_2$ $\therefore N_2 = 15$

\therefore 15 men are required.

Alternatively,
10 men = 3 hours
30 men = 1 hour
15 men = 2 hours

\therefore need 15 men \rightarrow 1mk

Question 32 (20 Marks)

(a) (i) $2x^2 - 26x + 72 = 0$
 $x^2 - 13x + 36 = 0$
 $(x-4)(x-9) = 0$
 $\therefore x = 4$ or $x = 9$ \rightarrow 1mk
 \rightarrow 1mk

(ii) $x^2 - 13x + 36 < 0$
 $\therefore 4 < x < 9$ \rightarrow 1mk

(b) $T_1 = \frac{1}{30}, T_2 = \frac{1}{40}$ \rightarrow 1mk

$S = \frac{\text{total distance}}{T_1 + T_2} = \frac{2}{\frac{1}{30} + \frac{1}{40}} = 34\frac{2}{7}$ \rightarrow 1mk

\therefore the average speed is $34\frac{2}{7}$ km / hour.

(c) The points $A(-5, -1), B(-1, 5)$ and $D(0, -3)$ are 3 vertices of a quadrilateral.

(i) 4th vertex $C = (4, 3)$ \rightarrow 1mk

(ii) $BD = \sqrt{(-1-0)^2 + (5+3)^2} = \sqrt{65}$ units \rightarrow 2mks

(iii) gradient = $\frac{5+3}{-1} = -8$ \rightarrow 1mk

$\therefore y+3 = -8(x-0)$
 $\therefore 8x+y+3=0$ \rightarrow 1mk

(iv) $d = \frac{|ax+by+c|}{\sqrt{a^2+b^2}} = \frac{|8(4)+1(3)+3|}{\sqrt{8^2+1^2}}$ \rightarrow 1mk
 $= \frac{38\sqrt{65}}{65}$ \rightarrow 1mk

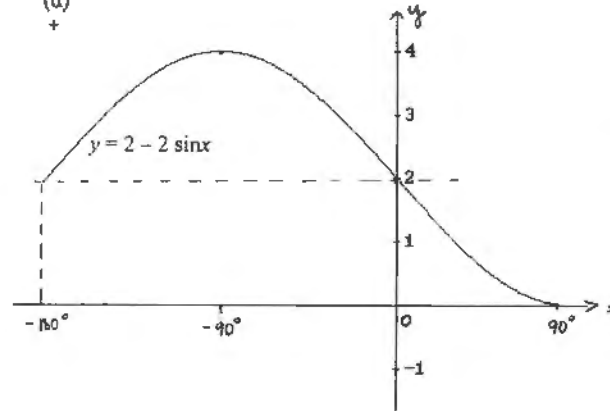
\therefore shortest distance is $\frac{38\sqrt{65}}{65}$ units from C.

(v) Area $ABCD = \frac{1}{2} \times BD \times d \times 2$
 $= \frac{1}{2} \times \sqrt{65} \times \frac{38\sqrt{65}}{65} \times 2$
 $= 38$

\therefore area of $ABCD$ is 38 square units.

\rightarrow 2mks

(d)



\rightarrow 1mk shape

\rightarrow 1mk domain

\rightarrow 1mk range

\rightarrow 1mk intercepts

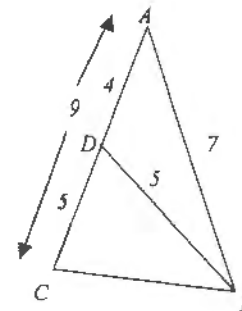
(e) $\frac{\sin X - 2\sin^3 X}{2\cos^3 X - \cos X} = \frac{\sin X(1 - 2\sin^2 X)}{\cos X(2\cos^2 X - 1)}$ \rightarrow 1mk

$= \frac{\tan X(1 - 2\sin^2 X)}{2 - 2\sin^2 X - 1}$ \rightarrow 1mk

$= \frac{\tan X(1 - 2\sin^2 X)}{1 - 2\sin^2 X}$
 $= \tan X$ \rightarrow 1mk

Question 33 (20 Marks)

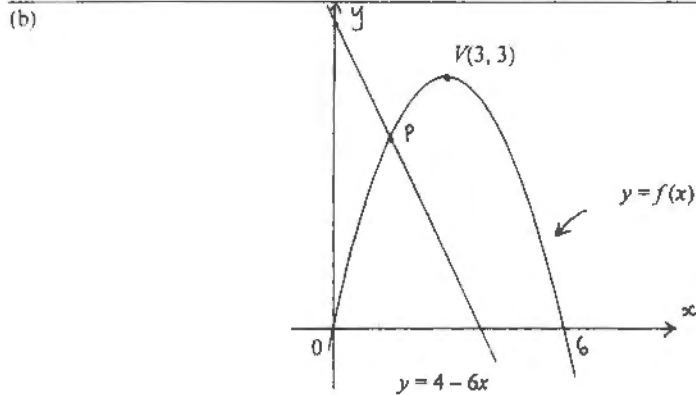
(a) (i)



\rightarrow 1mk

(ii) $\cos \angle ADB = \frac{4^2 + 5^2 - 7^2}{2 \times 4 \times 5} = -0.2 \rightarrow 2\text{mks}$

- (iii) $\angle ADB = 101^\circ 32'$ (negative cosine ratio gives obtuse angle in triangle)
 $\therefore \angle CDB = 78^\circ 28'$ (Straight angle $ADC = 180^\circ$) $\rightarrow 1\text{mk}$
 $\therefore \text{Area } \triangle CDB = \frac{1}{2} \times 5 \times 5 \times \sin 78^\circ 28' = 12.25 \rightarrow 1\text{mk}$
 $\therefore \text{Area is } 12.25 \text{ square units to 4 significant figures.}$



- (i) Need equation $y = ax(x-6)$
 As $V(3, 3)$ lies on the parabola, $3 = 3a(3-6) \therefore a = -\frac{1}{3} \rightarrow 1\text{mk}$
 \therefore equation is $3y = -x(x-6)$ OR $3y = x(6-x) \rightarrow 1\text{mk}$

(ii) $4 - 6x = \frac{x}{3}(6-x)$
 $\therefore 12 - 18x = 6x - x^2$
 $\therefore x^2 - 24x + 12 = 0$
 $x = \frac{24 \pm \sqrt{24^2 - 4(12)}}{2} = \frac{24 \pm \sqrt{528}}{2} = 12 \pm 2\sqrt{33} \rightarrow 1\text{mk}$

- but P lies between $0 \leq x \leq 3$,
 $\therefore 12 - 2\sqrt{33} \approx 0.51$ is the only solution for P . $\rightarrow 1\text{mk}$
 \therefore coordinates of P are $(12 - 2\sqrt{33}, -68 + 12\sqrt{33}) \rightarrow 1\text{mk}$

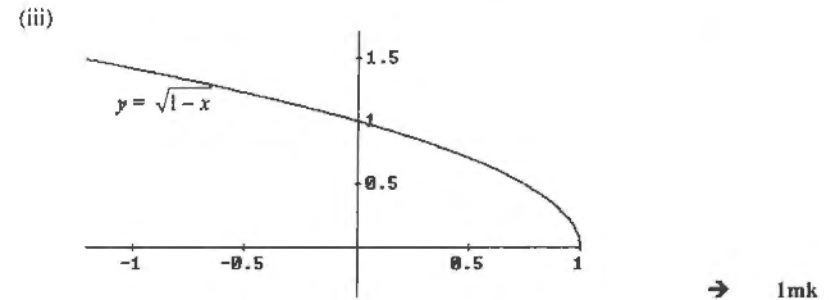
(c) $\text{Area} = \frac{1}{2} \times ab \sin \angle BAC$
 $\therefore 1.7 = \frac{1}{2} \times 0.75 \times 4.8 \times \sin \angle BAC$

$\therefore \sin \angle BAC = 0.94 \rightarrow 1\text{mk}$
 $\therefore \angle BAC = 70^\circ 49'$ or $109^\circ 11'$ $\rightarrow 1\text{mk}$

(d) $\tan 120^\circ = \frac{x+1}{-3-2} \rightarrow 1\text{mk}$
 $-\sqrt{3} = \frac{x+1}{-5} \therefore x = 5\sqrt{3} - 1 \rightarrow 1\text{mk}$

(e) (i) Domain: $\{x : x \leq 1\}$ $\rightarrow 1\text{mk}$
 Range: $\{y : y \geq 0\}$ $\rightarrow 1\text{mk}$

(iii) $y = \sqrt{1-x}$ is a function as for every x value in its domain there exists a unique y value. $\rightarrow 2\text{mks}$



Question 34 (20 Marks)

- (a) (i) $5\sin^2 A + \cos^2 A - 1 = 5(1 - \cos^2 A) + \cos^2 A - 1$ $\rightarrow 1\text{mk}$
 $= 4 - 4\cos^2 A \rightarrow 1\text{mk}$
 (ii) $5\sin^2 A + \cos^2 A - 1 = 0$
 $4 - 4\cos^2 A = 0$
 $1 = \cos^2 A$
 $\therefore \cos A = \pm 1 \rightarrow 1\text{mk}$
 $\therefore A = 0^\circ, 360^\circ, 180^\circ \rightarrow 1\text{mk}$

(b) (i)
$$\begin{array}{r} 2x+7 \\ (x-4)\overline{)2x^2-x-3} \\ \underline{2x^2-8x} \\ 7x-3 \\ \underline{7x-28} \\ 25 \end{array} \rightarrow 2\text{mks}$$

 \therefore the remainder is 25.

(ii) $y = \frac{2x^2 - x - 3}{x - 4}$