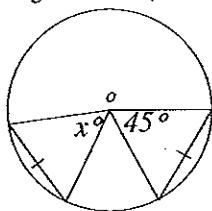


James Ruse Agricultural High School

Year 8 Mathematics Exam 2006

Question One: (1 mark each)

- a) What is the cardinal number of the set of the letters of the alphabet?
- b) Expand $(2x - 5)^2$.
- c) Find the value of x giving full reasons; 'O' is the centre of the circle:



- d) Simplify $\frac{4x+8}{2}$
- e) If a square has a perimeter of 80cm, what is its area?
- f) Do the diagonals of a parallelogram bisect the angles at the vertices?
- g) What is the probability that a person is born on the weekend?
- h) If \$2 445 is divided in the ratio 3:2, what is the size of the smallest share?
- i) What is the probability of rolling a number greater than 4 with an ordinary die?
- j) Calculate the surface area of a cube with sides of 7.2mm.
- k) Evaluate $\frac{(41.84)^5 + \sqrt{31.99}}{67.9 + \pi}$ correct to two decimal places.
- l) Write down one general property of a kite, which isn't a general property of a trapezium.
- m) Find the simple interest earned if \$750 is invested for 4 years at 3.5% p.a.
- n) How many days in G weeks?
- o) Find the median for the following set of numbers: 12, 3, 11, 5, 6, 10, 9, 13 and 7.

Question Two: (15 marks) Start a new page!

Marks

- a) Stephanie earns \$18.40 per hour for a 38 hour working week. Any overtime is at time-and-a-half. Calculate her wage if she works a 43 hour week. 2
- b) A number is increased by 15% and the result is then decreased by 40%. If the final result is 862.5, find the original number. 1
- c) Factorise fully $x^4 - 16y^4$. 2
- d) Solve $15 - \frac{2x}{3} \leq -12$. 3
- e) Find the compound interest on \$4 500 at 6%p.a. compounded monthly for 12 years. 3
- f) The diagonals of a rhombus are 13cm and 6cm in length. Find the perimeter and area of this rhombus. (Answer to one decimal place where necessary). 3
- g) From the word "calculator" a letter is chosen at random; find the probability that it is a vowel. 1

Question Three: (15 marks) Start a new page!

- a) Using the table of values below write down a formula linking m and n ; (express your answer in the form " $n = \dots$ "): 1

m	1	2	3	4
n	-1	1	3	5

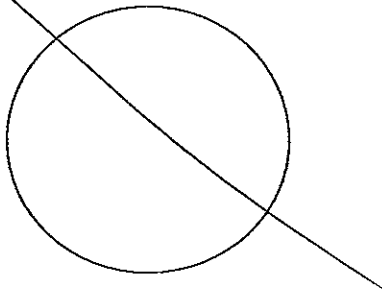
- b) A person's gross income is \$125 400 p.a. His tax free threshold is \$6 000. If their tax is paid at a rate of 32 cents in the dollar, determine their net income? 2

- c) When a ball is thrown vertically upwards, its height, h metres, above the ground after t seconds is given by: $h = 40t - 10t^2$.

- i) How high will the ball be above the ground after 2.5 seconds? 1
 ii) When will the ball be 30m above the ground? 2
 iii) How long will the ball be in the air? 2
 iv) What is the highest point reached by the ball? 1

- d) Make x the subject of $y = \frac{x}{x+1}$ 3

- e) If O is the centre of the circle, find the value of x giving full reasons: Diagram not drawn to scale. 3



Question Four: (15 marks) Start a new page!

- a) Solve $12 - 2x = 6x - x^2$ 2

- b) Make x the subject of $y = \sqrt{x+1}$ 2

- c) A darts team manager was deciding which of two players should be selected for a championship event. He had the scores of the two players from their previous ten games:

Player A : 180 32 100 36 55 180 96 48 61 103

Player B : 121 86 71 102 68 96 73 105 113 56

- i) Find the mean and range for both sets of scores. 2
 ii) Decide which of the two players the manager should select, using your answers to part i) to justify your answer. 1

- d) A cylindrical rain water tank has a diameter of 3 metres and a height of 4 metres. The water from the rain water tank runs into a holding tank underneath the ground. The holding tank is in the shape of a rectangular prism of length 5 metres, breadth 4 metres and depth 6 metres.

- i) If the rain water tank is full and all of the water runs into the holding tank, what percentage of the volume of the holding tank will be filled? Answer to 4 significant figures. 2
 ii) If the rain water tank empties uniformly in $2\frac{1}{4}$ hours calculate this rate in ml/s. (Answer correct to two decimal places). 3

- e) Of 120 pupils in Year 8, 36 take Visual Arts, 56 Japanese and 64 Commerce. 20 students take both Commerce and Visual Arts and 12 take all three. 12 study Visual Arts only and 24 Japanese only.

- i) Draw a Venn Diagram to illustrate the above information. 2
 ii) Find the probability that a student chosen at random studies Commerce and Japanese. 1

END OF PAPER !

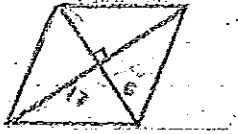
Question 1.

- a) n (letters of the alphabet) = 26 ✓
 b) $(2x-5)(2x-5) = 4x^2 - 10x - 10x + 25$
 $= 4x^2 + 25 - 20x$ ✓
 c) $x = 45$ (equal chords subtend equal angles at the centre) ✓
 d) $20x + 9$
 $= 2(x+2)$ ✓
 e) Perimeter = 80
 \therefore side length = $\frac{80}{4}$
 $= 20$ ✓
 \therefore Area = 20^2
 $= 400 \text{ cm}^2$ ✓
 f) Yes ✓
 g) $P(\text{person is born on a weekend}) = \frac{2}{7}$ ✓
 h) $\frac{\$2895}{5} = 689$
 $689 \times 2 = 978$ ✓
 \therefore the smallest share is \$978 ✓
 i) $P(\text{number is greater than 4}) = \frac{2}{6}$
 $= \frac{1}{3}$ ✓
 j) $SA = 7.2^2 \times 6$
 $= 311.04 \text{ mm}^2$ ✓
 k) $\frac{1}{100} \times 1804869.098 \dots$ ✓
 $= 1804869.10$ (2 d.p.) ✓
 l) Two adjacent sides are equal ✓
 m) $\$750 \times 3.5\% = \125 ✓
 n) 76 ✓
 o) median = 5, 6, 7, 11, 12, 13
 median = 9 ✓

Question Two.

- a) ~~18.40~~ or Let r be Stephanie's hourly rate
 $r = \frac{18.40}{38}$ ✓
 $\frac{1}{2}(43-38) \times r =$
 $\$18.40 \times 38 + 1.5(18.40 \times (43-38)) = 837.2$ ✓
 \therefore Her wage is \$837.20 ✓
- b) Let the original number be x
 $(x \times \frac{115}{100}) \times \frac{60}{100} = 862.5$
 $(x \times \frac{115}{100}) = 862.5 \times \frac{100}{60}$
 $x = 862.5 \times \frac{100}{60} \times \frac{100}{115}$
 $= 1250$ ✓
 \therefore the original number is 1250 ✓
- c) ~~(x^2 + 4y^2)(x^2 - 4y^2)~~
 $(x^2 + 4y^2)(x^2 - 4y^2)$
 $(x^2 + 4y^2)(x-2y)(x+2y)$ ✓
- d) $15 - \frac{2x}{3} \leq -12$
 $-\frac{2x}{3} \leq -27$ ✓
 $2x \leq -81$
 $2x \geq 81$ ✓
 $x \geq 40\frac{1}{2}$ ✓
- e) ~~4500~~ $I = 4500(1 + \frac{0.06}{12})^{144} - 4500$ ✓
 $= 4728.37867 \dots$
 $= \$4728.38$ (nearest cent) ✓
 \therefore the compound interest is \$4728.38 ✓

f)



$$\begin{aligned} \text{Area} &= \frac{6 \times 13}{2} \\ &= 3 \times 13 \\ &= 39 \text{ cm}^2 \checkmark \end{aligned}$$

Let s be the side length

$$\begin{aligned} \text{Then } \left(\frac{13}{2}\right)^2 + \left(\frac{6}{2}\right)^2 &= s^2 \quad (\text{pyth. thm}) \\ 42.25 + 9 &= s^2 \\ s^2 &= 51.25 \\ \therefore s &= \sqrt{51.25} \checkmark \\ &= 7.158 \text{ m} \end{aligned}$$

$$\begin{aligned} \therefore \text{Perimeter} &= 4\sqrt{51.25} \\ &= 28.6356 \text{ (2 d.p.)} \\ &= 28.6 \text{ cm (1 d.p.)} \end{aligned}$$

$$\begin{aligned} 9) P(\text{vowel}) &= \frac{6}{16} \\ &= \frac{3}{8} \checkmark \end{aligned}$$

Question 3

a) $n = 2m - 3 \checkmark$

* b) Net income = $125000 - (125000 - 6000) \times 0.32 + 6000$
 $= 125000 - (119000 \times 0.32) + 6000$
 $= 125000 - 38080 + 6000$
 $= 92920$

c) i) $h = 40(2.5) - 10(2.5)^2$
 $= 37.5 \checkmark$

\therefore The ball will be 37.5 m above the ground.

ii) $30 = 40t - 10t^2$

$$10(4t - t^2) = 30$$

$$4t - t^2 = 3 \Rightarrow t^2 - 4t + 3 = 0$$

$$(t-1)(t-3) = 0$$

$$\therefore t = 3 \text{ or } 1 \text{ sec. } t = 1 \text{ or } 3$$

\therefore The ball will be 30 m above the ground after 1 or 3 seconds.

iii) $0 = 40t - 10t^2$, where $t > 0$

$$10(4t - t^2) = 0$$

$$4t - t^2 = 0 \checkmark$$

$$4t = t^2$$

$$\therefore t = 4$$

\therefore The ball will be in the air for 4 seconds.

* i) $h = 40 \times 2 - 10 \times 2^2$
 $= 80 - 40$
 $= 40$

At 2 sec, the ball is at the top of the climb. \therefore Let $t = 2$

\therefore The highest point reached by the ball is 40 m.

* d) $y = \frac{x}{x+1}$

$$x - y = \frac{xy}{x+1} \quad x = \frac{y}{1-y}$$

$$x = \frac{xy}{x+1}$$

$$x = \frac{xy}{x+1} \Rightarrow x(x+1) = xy$$

$$x = y(x+1)$$

$$x = xy + y \Rightarrow x - xy = y \Rightarrow x(1-y) = y$$

Question 4

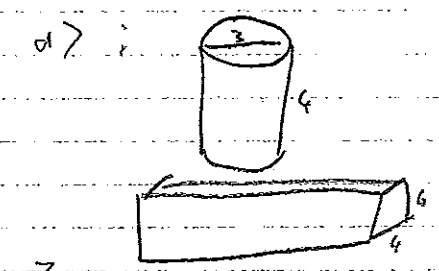
a) $12 - 2x = 6x - x^2$
 $-2x = 6x - x^2 - 12$
 $-8x = -x^2 - 12$
 $8x = x^2 + 12$
 $8x - x^2 = 12$ Solve a quadratic
 $x^2 - 8x + 12 = 0$
 $(x-6)(x-2) = 0$
 $x = 6$ or 2

b) $y^2 = x + 1$
~~is not~~
 $x = y^2 - 1$
 $x = 89.1$

c) i. $\text{mean}_A = 89.1$
 $\text{mean}_B = 89.1$

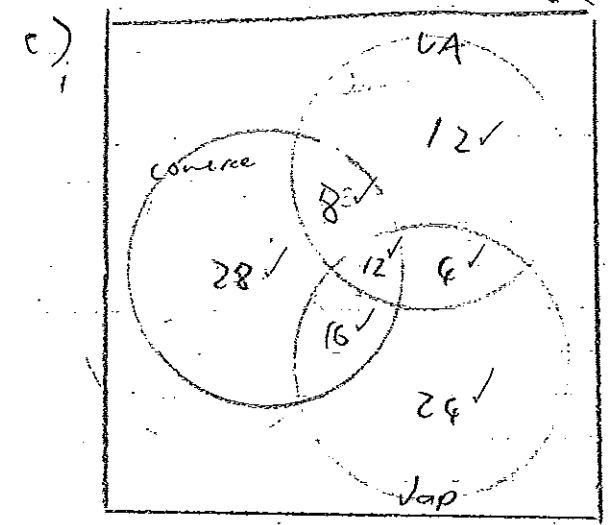
range $A = 180 - 32 = 148$
 $\text{range}_B = 121 - 58 = 65$

ii. The manager can choose any of the two players for both teams in some ways.

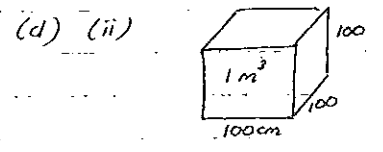


Percentage = $\frac{\frac{1}{2} \pi r^2 h}{5 \times 4 \times 6}$
 $= \frac{2.25 \pi}{30}$
 $= 0.2356 / 99.99$
 $= 23.56\%$ (2dp)

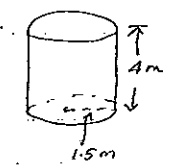
$\frac{7}{2} \pi \text{ m/s}$
 $= \frac{7 \cdot 22664626}{2} \text{ (2dp)}$
 $= 7.73 \text{ m/s}$
 $\frac{\pi}{h} = \frac{2 \pi}{2.5}$
 $= \frac{2.25 \pi}{2.5}$
 $= \frac{\pi}{1.11}$
 $\text{kl/min} = \frac{\pi}{60}$
 $\text{kl/sec} = \frac{\pi}{3600}$
 $\text{ml/sec} = \frac{1000 \pi}{3600}$



ii. $P(\text{Student studies Japanese and Commerce}) = \frac{8}{120}$
 $= \frac{28}{120}$
 $= \frac{7}{30}$
 $\text{or } = \frac{14}{50}$



1 cubic cm = 1 ml
 $1 \text{ m}^3 = 10^6 \text{ c.c.}$
 $= 10^6 \text{ ml}$



Vol. of cylinder
 $= \pi (1.5)^2 \cdot 4 \text{ m}^3$
 $= 28.274334 \times 10^6 \text{ ml}$

$\therefore \text{Rate of flow} = \frac{28.274334 \text{ ml}}{2.25 \times 60 \times 60 \text{ s}}$
 $= 3490.66 \text{ ml/s}$ (to 2dp)