NSW INDEPENDENT SCHOOLS

2007
Higher School Certificate
Trial Examination

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2 1/2 hours
- Write using black or blue pen
- Board-approved calculators may be used
- Draw diagrams using pencil
- A formulae sheet is provided separately
- Graph paper is provided separately
- Write your student number and/or name at the top of every page

Total marks – 100

Attempt ALL questions
This exam has two parts, Part A and Part B

Section 1 – Pages 2 - 11
Total marks (22)
Attempt Questions 1 – 22
Allow about 30 minutes for this section

Section II – Pages 12 - 23
Total marks (78)
Attempt Questions 23 – 28
Allow about 2 hours for this section

This paper MUST NOT be removed from the examination room

Section I

Total marks (22)
Attempt Questions 1 – 22
Allow about 30 minutes for this part

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below

	A	B	C	D
1				
2				
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22				

1. A speed limit of 40 km/h applies to all traffic within a school zone.
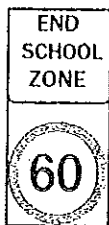
END SCHOOL ZONE 60

What is the percentage increase in speed allowed *after* the school zone ends?

(A) 20
(B) 33.3
(C) 50
(D) 66.7

2. James is working in a music studio. For each CD produced by an artist, James is required to write down details.

Which of the following is an example of discrete data?

(A) The title of the CD and the artist's name
(B) The number of tracks recorded on the CD
(C) The length of time of each track
(D) The title of each track

3. $\dfrac{\sqrt{x}}{4} = 9$

What is the value of x in this equation?

(A) 6
(B) 144
(C) 324
(D) 1 296

4. A worker has 100 road cones. As shown below, they sit on 50 cm square bases and are to be placed 3 metres apart (from their centres).

NOT TO SCALE
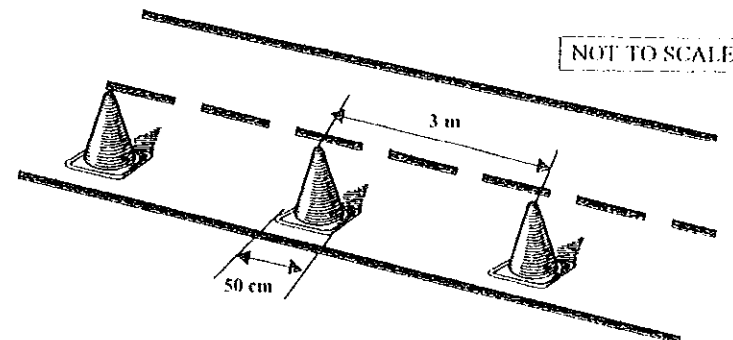
What distance will the road cones cover when placed as shown above?

(A) 300.0m
(B) 297.0m
(C) 300.5m
(D) 297.5m

5. A sporting event is being played in London and is being broadcast to Australia by the BBC world television network and received by ABC television Australia in Sydney. The table below gives the longitudes of the two networks.

Television Network	Location	Longitude
WORLD	London	0^0
	Sydney	150^0E

ABC Sydney broadcasts the start of play at 1:30 am Sunday local time live from London.

What time is it in London at the start of play?

(A) 10.00 pm on Saturday
(B) 3.30 pm on Saturday
(C) 11.30 am Sunday
(D) 11.00 pm on Sunday

6. The probability that a new variety of seed will produce flowers in the first year of growth after being planted is 0.4.
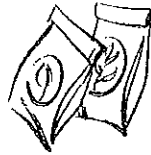
200 seeds of this new variety are planted.

How many of the seeds would be expected to produce flowers in the first year?

(A) 8
(B) 40
(C) 80
(D) 120

7. A cardboard cut out, as shown below, is in the shape of an ellipse forming the centre of a photo frame.

580 mm

Photo here

330 mm
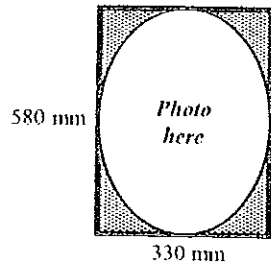
What is the approximate shaded area (in mm^2) of cardboard remaining in the photo frame?

(A) 41 075
(B) 47 850
(C) 150 325
(D) 553 451

8. Each identical isosceles triangle in the solid has a base length of 15 cm and a perpendicular height of 20 cm.
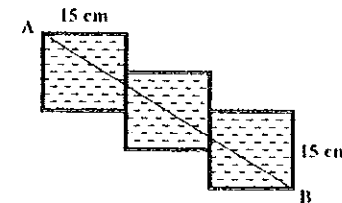

What is the surface area of the solid?

(A) 180 cm^2
(B) 1 200 cm^2
(C) 1 800 cm^2
(D) 3 600 cm^2

9. The weights (in kg) of a sample of 6 fish caught in a lake are shown:

2.75,   6.00,   3.75,   4.35   4.15,   3.25,

What is the standard deviation of this sample?

(A) 1.03
(B) 1.12
(C) 1.29
(D) 4.04

10. In a floor design three identical square tiles of side length 15 cm are placed on the floor as shown below.


15 cm

A

15 cm

B

Each tile is placed exactly half way along the side of the tile next to it.

What is the distance in centimetres between the corners A and B of the tiles in the pattern shown?

(A) 21.2
(B) 42.4
(C) 45
(D) 54.1

11. 8 000 mail articles were collected from a post office mail box over a weekly period. The box-and-whisker plot shows the weights (in grams) of the articles collected.


```
    |----[      |      ]----|
         120  150  200  250  300  350  400  450  500  gm
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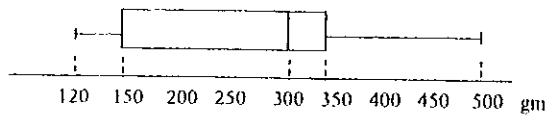
How many articles collected, weighed between 300 and 350 grams?

(A) 1 000
(B) 2 000
(C) 2 500
(D) 4 000

12. The money bag contains 18 silver coins and two gold coins all identical in size.

What is the probability that the first two coins randomly selected from the bag will be the gold coins?

(A) $\dfrac{1}{9}$

(B) $\dfrac{1}{10}$

(C) $\dfrac{1}{163}$

(D) $\dfrac{1}{190}$

13. In an assessment task the mean result recorded was 68% and the standard deviation was 8.

Kendal's assessment was recorded as 78%.

What was Kendal's Z- score?

(A) 1.25
(B) 2.00
(C) - 1.25
(D) - 2.00

14. An investment of $9 500 attracts interest at a rate of 4.8% per annum compounded every 6 months.

The amount of interest earned on this investment over a period of 5 years is:

(A) $9 500(1.048)^5$ - $950 013
(B) $9 500 + (1.024)^{10}$
(C) $9 500 + (1.024)^5$ - $9 500
(D) $9 500(1.024)^{10}$ - $9 500

15. The formula $T = \dfrac{c}{s} + \dfrac{m}{v}$ is used to calculate the time T it takes to travel c km in the city at s km/h and m km along motorways at v km/h.

Using this formula, the time to travel 15 km in the city at 45 km/h and 12.5 km along a motorway at 100 km/h would be?

(A) 11.4 minutes
(B) 19.6 minutes
(C) 27.5 minutes
(D) 45.8 minutes

16. At her party, Sandi notices that some balloons are losing air. She increases the volume of air in the balloons by 15%, but in tying the knot on the balloons, 5% of the air escapes.

By what percentage has the amount of air in the balloons increased as a result of Sandi's efforts?

(A) 5%
(B) 5.75%
(C) 9.25%
(D) 10%

17. A river borders a pasture for cattle grazing, as shown below.

River   *Pasture*   *Diagram not to scale*

12.5 m

5 m

P ◄— 8 m —► Q   R
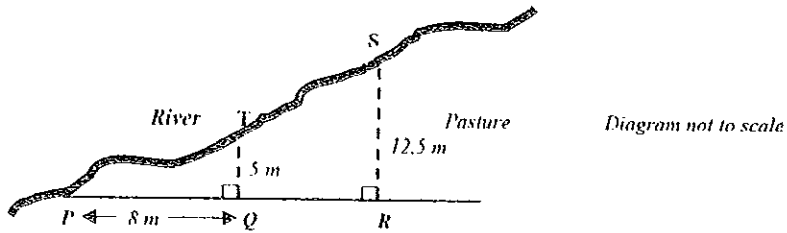
The farmer calculates distances taken from a horizontal line on the grazing land to the river bank as shown in the diagram where PTS is approximately a straight line.

What is the distance in metres, between the points Q and R on the grazing land?

(A) 7.5
(B) 12
(C) 15.5
(D) 20

18. The value of a cut diamond crystal varies as the square of its weight in carats. A crystal with weight 2 carats has a value of $2800.

What is the value of a cut diamond crystal with a weight of 3 carats?

(A) $2 100
(B) $3 733
(C) $4 200
(D) $6 300

19. After paying $500 deposit on a plasma television with a cash price of $5 000, Jason agreed to pay the balance at $225 per month over two years.

What was the annual simple interest rate charged under this agreement?

(A) 5%
(B) 7.5%
(C) 10%
(D) 20%

20. The graph below shows a comparison of the possible amount owing on a $50 000 loan. Monthly repayments of $600 are made over a period of 12 years. After 2 years, a lump sum of $5 000 may be paid directly off the loan, so that the loan is repaid earlier, after approximately 99 months.
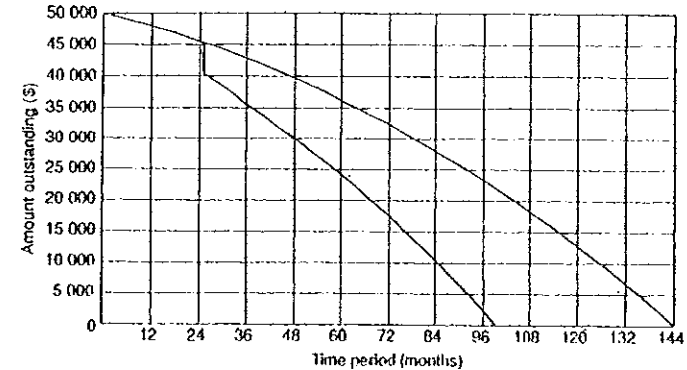
Over the period of repayments on the loan, what is the approximate saving that the $5 000 lump sum payment would make?

(A) $10 000
(B) $22 000
(C) $27 000
(D) $30 000

21. The isosceles triangle PQR has its two equal side lengths of 15 cm, base 20 cm and perpendicular height PS.

15 cm

S   42° R
20 cm
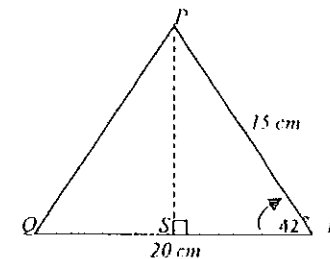
Which of the following *does not* give the length of PS?

(A) $15 \times \cos 42^0$
(B) $15 \times \sin 42^0$
(C) $\dfrac{10 \times \sin 42^0}{\sin 48^0}$
(D) $10 \times \tan 42^0$

22. Each of 5 identical cups, as shown below, contains an amount of liquid (mL). The cups are arranged from left to right with equal or increasing volume of liquid.

Cup 1   Cup 2   Cup 3   Cup 4   Cup 5

The following data is given about the contents of the cups:

    Mode: 6 mL Mean: 12 mL Median: 9 mL Range: 15 mL

What is the volume of liquid in Cup 4?

(A) 10 ml
(B) 15 ml
(C) 18 ml
(D) 21 ml

End of Section 1

Section II

Total marks (78)
Attempt Questions 23–28
Allow about 2 hours for this section

Answer each question on the paper provided, beginning each new question on a new page.

All necessary working should be shown in every question.

Question 23 (13 marks)   Mark

(a) A company manager earns an annual salary of $80 100 and is paid each fortnight.

From each fortnight's gross salary, the manager has deductions of $440 for superannuation, and $815 in taxation.

(i)   What is the manager's gross fortnightly salary?

(ii) Calculate the manager's normal net fortnightly salary.

(iii) In the pay for the last fortnight of the year, the manager is paid an additional 17.5% of 4 weeks gross salary as his annual holiday loading.
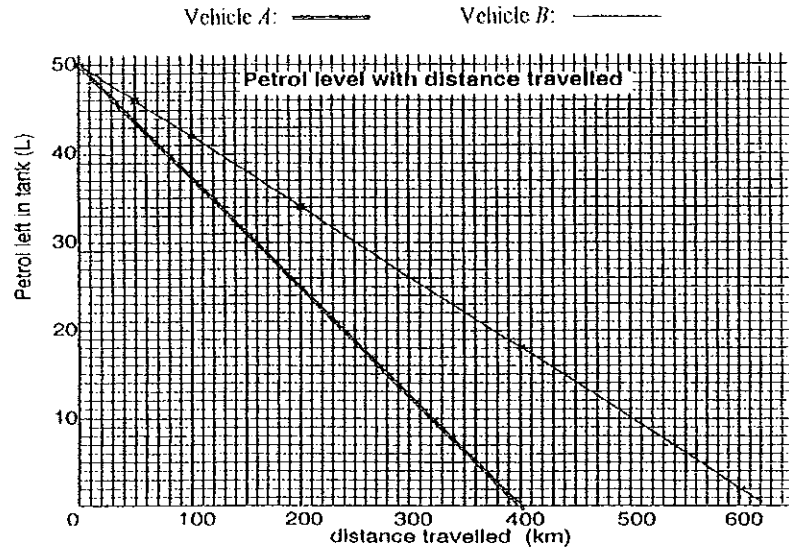
Determine the gross amount of the holiday loading.

(iv) If the holiday loading is taxed at a rate of 27.65%, determine the manager's net salary for the last fortnight of the year.

Question 23 (continued)   **Marks**

(b) The graph below shows a comparison of petrol usage for two vehicles with the same fuel tank capacity over distances travelled.

Vehicle A: ━━━━━   Vehicle B: ────────

(i) What is the capacity of the fuel tanks of the two vehicles?   1

(ii) Which vehicle uses less petrol per kilometre?   1

(iii) What distance does vehicle B travel on a full tank of petrol?   1

(iv) What is the fuel consumption in L/100 km for vehicle A?   1

(v) What is the difference in petrol usage between the two vehicles after 200 km?   1

(vi) After 20 litres of petrol have been used in both vehicles, what extra distance has vehicle B travelled?   1

(vii) The petrol (P) remaining in the fuel tank of vehicle A after travelling d km can be represented by the equation: $P = 50 - nd$.

What is the value of n in this equation?   1

End of Question 23

Question 24 (13 marks)   **Marks**

(a) Two poles are placed against either side of a brick wall from points on horizontal ground at S and R. The 8 metre pole reaches point P up the wall, and the 12 metre pole reaches the top of the wall at Q.
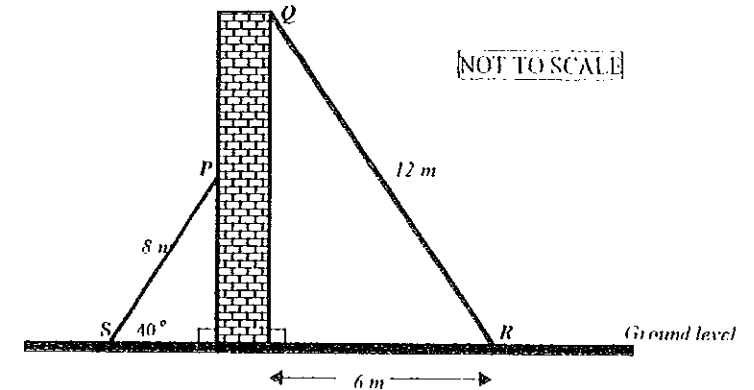
(i) Determine the distance (to one decimal place) that point P is above the ground level.   1

(ii) Calculate the angle of elevation of the 12m pole   2

(iii) What is the vertical distance (to one decimal place) between P and Q on the wall?   2

(iv) The 12m pole is moved so that it is now placed against the wall to reach the same height as P is above the ground.

How far past point R does this pole now extend along the ground?   2

Question 24 continues on the next page

Question 24 (continued)   Marks

Question 25 (13 marks)   Mark

(b)   A regular hexagonal spinner has four divisions with the numbers as shown:
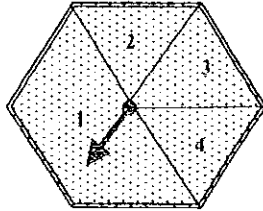
When the spinner is spun twice a 2 digit number is formed (example: 23).

(i)   What is the largest 2 digit number that can be formed?   1

(ii)   How many different two digit numbers can be formed from spinning twice?   1

(iii)   What is the probability that the arrow lands on the number 3 on the first spin?   1

(iv)   What is the probability that the number 31 is formed from two spins?   1

(v)   What is the probability that an odd two digit number is formed from two spins?   2

End of Question 24

(a)   A hemispherical dome of diameter 58 metres forms the roof of a building.
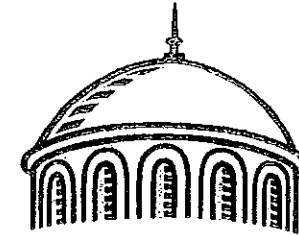
(i)   Calculate the volume of the roof to the nearest cubic metre.   2

(ii)   The density of a hemisphere is given by the formula.

Density   = $\dfrac{\text{Mass}}{\text{Volume}}$ measured in tonnes/m^3

Calculate the mass of the roof if its density is 75.5 kg/m^3.   2

(iii)   The interior surface of the hemispherical roof is covered with mosaic tiles measuring 6 cm x 6 cm.

By calculating the surface area of the roof, determine approximately how many tiles were used.   2

Question 25 continues on the next page

Question 25 (continued)   **Marks**
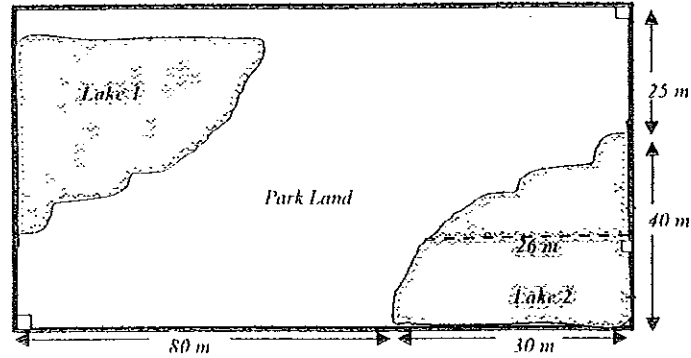
(b)   A rectangular section of land in a new housing estate, as shown below, encloses two identically designed artificial lakes of equal surface area next to park land.


(i)   Use Simpson's Rule to find the total surface area of the two lakes?   2

(ii)   Calculate the area of parkland enclosed within the rectangular section.   2

(iii) Lake 2 is on a bearing of 120^0 from Lake 1.

       What is the bearing of Lake 1 from Lake 2?   3

End of Question 25

Question 26 (13 marks)   **Marks**

(a)   A pair of compasses with 8 cm arms, as shown below, has been opened at an angle of 30^0 to allow a circle to be drawn.
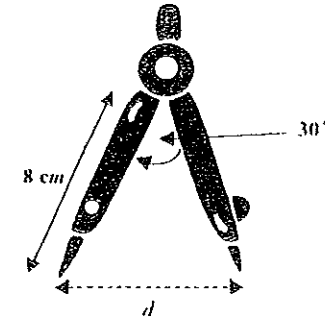
(i)   Identify the distance d between the tips, that the arms of the compass represent when drawing the circle.   1

(ii)   Use the cosine rule to determine the distance d to the nearest whole number.   2

(iii) Calculate the area of the circle being drawn, correct to 3 significant figures. 2

(b)   A speed camera was tested for its accuracy in detecting cars speeding. A table showing the camera's assessment in a number of trials is shown. Also shown in the table, is an accurate independent assessment of the cars speed.

| | Camera Assessments | |
	Speeding	Not speeding
Independent Radar Assessment *Cars actually speeding*	48	2
Independent Radar Assessment *Cars not actually speeding*	3	417

(i)   In how many trials was the camera's accuracy tested.   1

(ii)   In what percentage of the trials was the speed of the cars assessed *incorrectly*?   2

(iii) What percentage of all cars were incorrectly assessed as *speeding* by the camera?   1

Question 26 continues on the next page

Question 26 (continued)   Marks

(c)   The city of Osaka, Japan (J) has co-ordinates (37^0 N, 135^0 E) and Alice Springs in
      Northern Territory, Australia (A) has co-ordinates: (23^0 S, 135^0 E).

      (i)   Determine the size of the angle JOA, where O is the centre of the Earth.   1

      (ii) Calculate the distance between Osaka and Alice Springs to the nearest kilometre.
            (assume the radius of the Earth as 6400 km)   2

      (iii) A plane travels between the two cities at an average speed of 685 km/h. Calculate
            the flight time in hours and minutes.   1

End of Question 26

Question 27 (13 marks)   Mark:

(a)   A number of containers of toxic liquid waste were found on an old building site. The
      contents (in litres) of all the containers were recorded in a cumulative frequency graph,
      as shown below.

Liquid waste *(litres)*
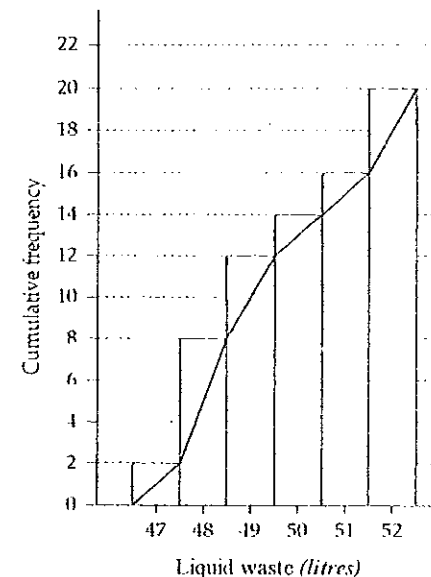
      (i)   How many containers were found on the building site?   1

      (ii)   What was the mode amount of liquid found in the containers?   1

      (iii) What was the inter-quartile range of liquid found in the containers?   2

      (iv)   Comment on whether the recorded data suggests skewness in the distribution of
             liquid found in the containers.   1

      (v)   Comment on whether the recorded data suggests a normal distribution of liquid
             found in the containers, giving reasons to support your conclusion.   2

Question 27 continues on the next page

Question 27 (continued)

(b) A game board consists of 9 identical cube boxes with colours shown on the front.
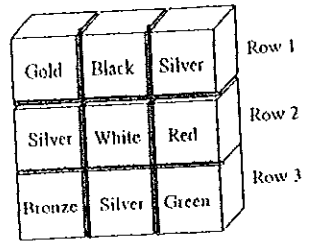
The boxes in the **rows only** can be randomly interchanged in any position in the row.

(i) In how many ways can the boxes in each row be arranged?   1

(ii) In how many ways can the boxes on the game board be arranged?   1

(iii) What is the probability that the white box will appear in the middle of the board?   2

(iv) What is the probability that the silver boxes will appear diagonally on the board?   2

End of Question 27

Question 28 (13 marks)

(a) A formula relating H and k is given by:

$$H = 6 + 2k^3$$

(i) Find the value of k if $H = 60$.   2

(ii) If k doubles in value, determine the percentage change in H.   2

(b) The graph below shows the depreciation of an asset over ten years, using a comparison between the straight line method of depreciation (Q) and the declining balance method (P).
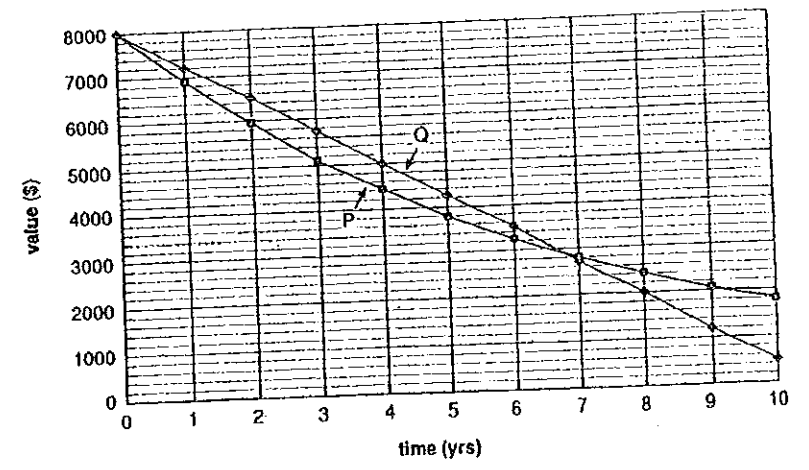
The Australian Taxation Office allows the declining balance *rate of depreciation* to be 1.5 times the straight line depreciation rate of any asset.

By determining the straight line rate of depreciation from the graph, calculate the declining balance *rate of depreciation*, as a percentage, used to depreciate the asset over the ten year period.   3

Question 28 (continued)

Marks

(c)   The mass (M) of a baby orang-utan can be modelled by the equation:

$$M = 1.5 (1.2)^t$$

where t is the time after birth in months.

(i)   Using this equation, what was the birth mass of the orang-utan?   1

(ii)   What is the percentage rate of increase in mass of the orang-utan per month?   1

(iii)   What would the solution of the equation: $(1.2)^t = 2$ represent, in relation to the increase in mass of the orang-utan?   1

(iv)   By calculation with trial and error, solve this equation stating the approximate value of t?   1

Answer the following question on the graph paper provided separately.

(v)   Sketch a well labelled graph of the change in mass of the orang-utan over t months. Your graph should clearly show the shape of the graph, and values obtained from parts (i) and (v) above.   2

End of paper

Question 28 (c)(v) – *Graph Paper*
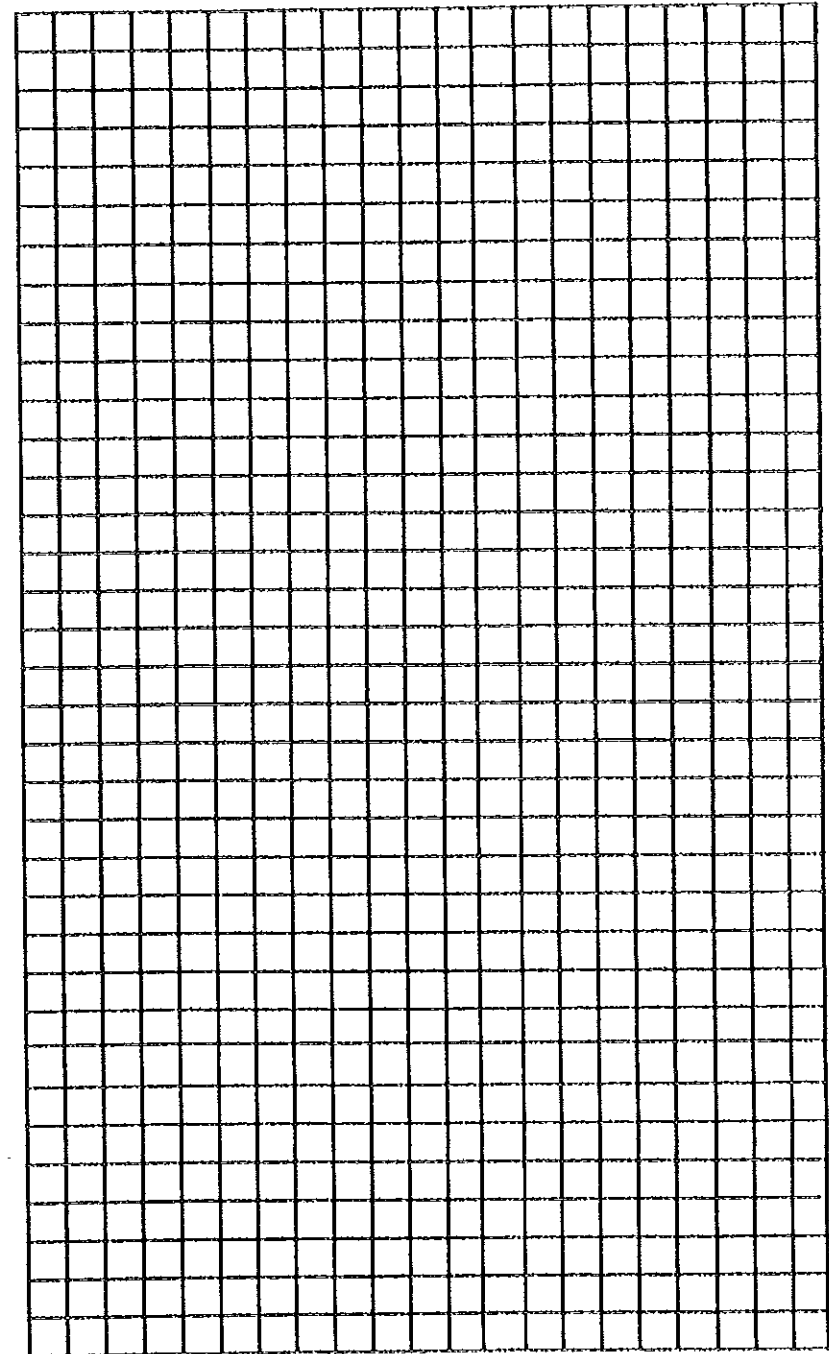
NSW INDEPENDENT TRIAL EXAMS – 2007
GENERAL MATHEMATICS – HSC TRIAL
MARKING GUIDELINES

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
C	B	D	D	B	C	A	C	B	D	B	D	A	D	C	C	B	D	C	C	A	C

Section II
Question 23

Part	Answer	Mark	Outcome Assessed	Band
(a) i	$80\ 100 \div 26 = \$3080.77$	1	FM1, P7	2
(a) ii	$3080.77 - (\$440 + \$815) = \$1825.77$	1	FM1, P7	2/3
(a) iii	$3080.77 \times 2 \times 0.175 = \$1078.27$	2	FM1, P2, P7	3
(a) iv	Tax on loading = 0.2765 = $298.14 Net load = $1078.27 - $298.14 = $780.13 Net fortnight salary = $2605.90 using (ii)	2	FM1, P7	3/4
(b) i	50L	1	DA3, P4	2
(b) ii	Vehicle B	1	DA3, P7	2/3
(b) iii	About 625 km (accept 620 km)	1	DA3, P7	2
(b) iv	50L/400km = 12.5 $L/100\ km$	1	AM2, P5	3/4
(b) v	About 9 or 10 L	1	AM2, P5	3
(b) vi	255 km - 160 km = 95 km	1	AM2, P5	3/4
(b) vii	'n' represents the gradient of the graph. In this case n = 50/400 = 1/8 or 0.125	1	AM2, P3	4

Question 24

Part	Answer	Marks	Outcome Assessed	Band
(a) i	$\sin 40° = \dfrac{h}{8}$ $h = 8 \times \sin 40°$ $= 5.1\ m$	1	M4, P6	3/4
(a) ii	$\cos\varphi = \dfrac{6}{12}$ $\phi = 60°$	2	M4, P6	3/4
(a) iii	Height of wall $= \sqrt{12^2 - 6^2} = 10.4\ m$ Vertical dist = 10.4 m - 5.1 m = 5.3 m	2	M4, P6, P7	3/4
(a) iv	New dist along ground $= \sqrt{12^2 - 5.1^2}$ $= 10.9\ m$ Distance past R = 10.9 - 6 = 4.9 m	2	M4, P7	4
(b) i	44	1	PB1, P3	1
(b) ii	16	1	PB3, H4	4
(b) iii	1/6	1	PB2, P7	3/4
(b) iv	1/6 × ½ = 1/12	1	PB3, H4	3/4
(b) v	2/3	2	PB3, H10	4

Question 25

Part	Answer	Marks	Outcome Assessed	Band
(a) i	$V = \frac{1}{2} \times 4/3 \times \pi \times 29^3 = 51080 m^3$	2	M2, P6	3/4
(a) ii	Mass = 51080 × 0.0755 = 3856.54 tonnes	2	AM3, H3	3/4
(a) iii	$SA = \frac{1}{2} \times 4 \times \pi \times 29^2 = 5284.12 m^2$ Number of tiles = 5284.12 ÷(0.06×0.06) = 1 467 822	3	M5, H2, H6	4/5
(b) i	Area = 2 × $\dfrac{20}{3}$ (30 + (4×26) + 0) = 1786.7m^2	2	M5, H7	4/5
(b) ii	Area of parkland = 110m × 65m - 1786.7 = 5363.3 m^2	2	M2, P6	3/4
(b) iii	270° + 30° = 300° T	2	M6, H7	5
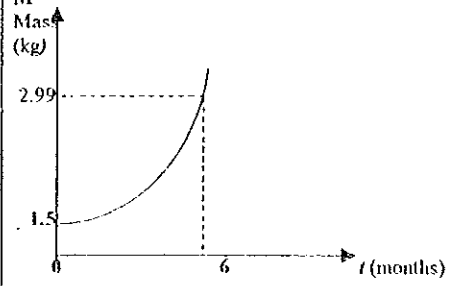
Question 26

Part	Answers	Marks	Outcome Assessed	Band
(a) i	The radius of the circle	1	M6, H2	2-3
(a) ii	$d^2 = (8^2 + 8^2 - 2 \times 8 \times 8 \times Cos30°)$ $d = 4$ (to the nearest whole number	2	M6, H7	4
(a) iii	Area $= \pi r^2$ where $r = 4$ (from (ii)) $= 50.3 \ cm^2$ (3 sig fig)	2	M5, H7	3-4
(b) i	470	1	PB4, H4	2-3
(b) ii	$\dfrac{5}{470} \times 100 = 1.06\%$	2	PB4, H4	4
(b) iii	$\dfrac{3}{470} \times 100 = 0.64\%$	1	PB4, H11	4-5
(c) i	$37° + 23° = 60°$	1	AM3, M7,	3
(c) ii	$\dfrac{60}{360} \times 2 \times \pi \times 6400 = 6702 \ km$	2	M7, H7	4-5
(c) iii	$6702 \div 685 = 9.78$ hours $= 9$ hours 47 min	1	M1, P7	3

Question 27

Part	Answer	Marks	Outcome Assessed	Band
(a) i	20	1	DA3, P4	2-3
(a) ii	48	1	DA3, DA5, H4	3-4
(a) iii	Median $= 49L$ Inter-Quartile Range $= 51L - 48L$ $= 3L$	2	DA5, H9	5
(a) iv	Considering the lowest and highest extremes and the lower and upper quartiles, there appears to be no skewness indicated by the recorded data. (47-48, 51-52)	1	DA5,H4,H5, H11	4-5
(a) v	Even though there appears to be no skewness, the median and mode are different and a sketch of a frequency histogram indicates a non-symmetrical distribution of liquid in the containers. The distribution is therefore not normal.	2	DA5, H11	5
(b) i	$3 \times 2 \times 1 = 6$ ways	1	PB3, H10	4
(b) ii	$6 \times 6 \times 6 = 216$	1	PB3, H10	4-5
(b) iii	$\dfrac{6 \times 2 \times 6}{216} = \dfrac{1}{3}$	2	PB3, H4	4-5
(b) iv	$\dfrac{4 \times 2 \times 4}{216} = \dfrac{4}{27}$	2	PB3, H4	5

Question 28

Part	Answer	Marks	Outcome Assessed	Band
(a) i	$60 = 6 + 2k^3$ $54 = 2k^3$ $27 = k^3$ $k = 3$	2	AM4, H3	5
(a) ii	Assume $k = 6$, then $H = 6 + (2 \times 6^3)$ $= 438$ % increase in H is: $\dfrac{438 - 60}{60} \times 100\%$ $= 630\%$	2	AM4, H11	5
(b)	Using the straight line, loss in value is $7500 over 10 years. This is $750 per year. % rate of depreciation per year is $\dfrac{750 \times 100}{8000}$ $= 9.365\%$ Declining balance rate is $9.375\% \times 1.5$ $= 14.07\%$	3	FM6, H2, H5, H8	5
(c) i	When $x = 0$, M = 1.5 (birth mass)	1	AM4, H3	4-5
(c) ii	20% per month increase in mass	1	AM4, H5	5
(c) iii	The solution to the equation would be the time in months it would take for the baby orang-utan to double its mass.	1	AM4, H11	5
(c) iv	By a number of trials, $t = 6$ (M approx 2.98)	1	AM3, H7.	5
(c) v	Exponential graph 	2	AM4, H2	5

The Trial examination and marking guidelines/suggested answers have been produced to help prepare students for the HSC to the best of our ability.
Individual teachers/schools may alter parts of this product to suit their own requirement.