NSW INDEPENDENT SCHOOLS

2013
Year 10 Final Exam
Stage 5.2

Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 1.5 hours
- A formula sheet is provided
- Board approved calculators may be used
- Write using black or blue pen
- Draw diagrams using pencil
- Write your student number and/or name at the top of every page

Total marks – 80

Section I – Pages 2–9
20 marks
- Attempt Questions 1–20
- Allow about 30 minutes for this Section

Section II – Pages 10–20
60 marks
- Attempt Questions 21–25
- Allow about 60 minutes for this section

This paper MUST NOT be removed from the examination room

1 The point (–2, 3) is reflected in the y-axis.

What are the co-ordinates of the reflection point?

(A) (–3, 2)　　　(B) (–3, –2)　　　(C) (2, –3)　　　(D) (2, 3)

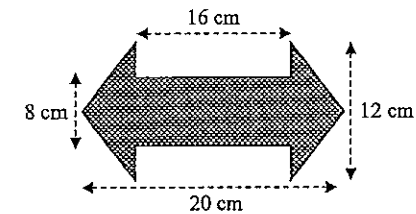**2** If p has the value of –4, what is the value of $2p^2$?

(A) –64　　　(B) –32　　　(C) 32　　　(D) 64

3 The time-and-a-half rate of pay for a casual position is $42.30.

What is the double time hourly rate?

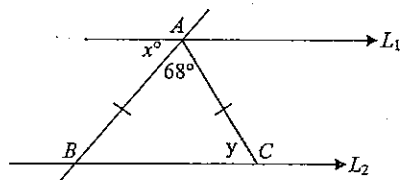(A) $56.40　　　(B) $63.45　　　(C) $70.50　　　(D) $84.60

4 This shape consists of a rectangle with congruent triangles at each end.

What is the area (in square centimetres) of the shape?
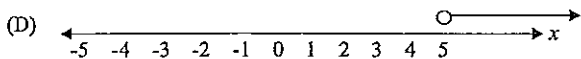
(A) 88　　　(B) 128　　　(C) 152　　　(D) 176

5 In the diagram, $AB = AC$ and the lines L_1 and L_2 are parallel.

Which of these statements is correct?

(A) $x + y = 68$ (B) $x = y$ (C) $x + y = 66$ (D) $x - y = 112$

6 Which of the number line graphs correctly shows the solution to $-2x - 4 < 6$?

(A)

(B)

(C)

(D)
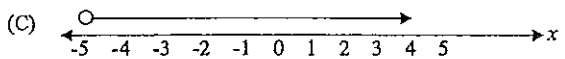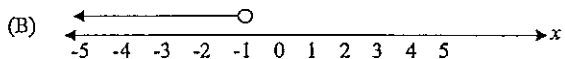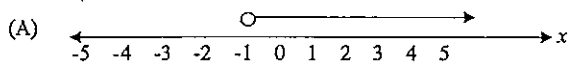
7 $\dfrac{4a - 12}{12} =$

(A) $4a - 1$ (B) $\dfrac{a-3}{3}$ (C) $\dfrac{a-12}{3}$ (D) $a - 4$

8 Kathy has achieved the following results on 5 Mathematics assessment tasks:

68%, 74%, 74%, 78%, 82%

On a 6th assessment task, Kathy achieves a result of 74%.

Which of the following will change as a result of the recording of Kathy's last task?

(A) Mode (B) Range (C) Median (D) Mean

9 Two of the vertices of the right-angled triangle PQR are given in the diagram.
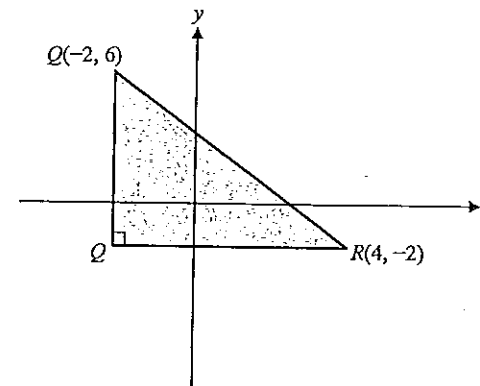
What is the area (in square units) of the triangle?

(A) 6 (B) 18 (C) 24 (D) 36

10 $8 - (3 - 2p) =$

(A) $5 + 2p$ (B) $8 - p$ (C) $8 + p$ (D) $5 - 2p$

11   The price of petrol increases overnight by 7 cents per litre and sells for $1.68 per litre the next morning.

What was the percentage increase in the price of petrol?

(A)   4   (B)   4.2   (C)   4.35   (D)   9.6

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12   The number of text messages sent by people at a party one evening is shown in this frequency histogram.
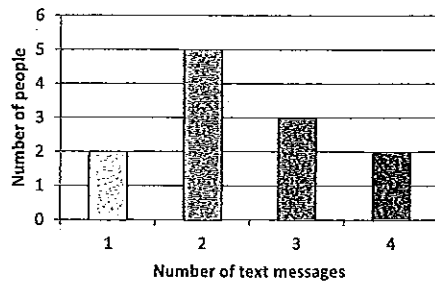
Which of the following statements is correct about the information shown?

(A)   The mode number of text messages sent was 5.

(B)   12 text messages were sent in total.

(C)   29 people sent text messages.

(D)   The mean number of text messages sent per person at the party was 2.4.

---

13   Mary is y years old and her brother Daniel is 3 years younger.

What is the total of Mary and Daniel's ages?

(A) $3-y$ (B) $y+3$ (C) $2y-3$ (D)   3

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14   The area of the front surface of this hexagonal nut is known to be 94 cm^2.
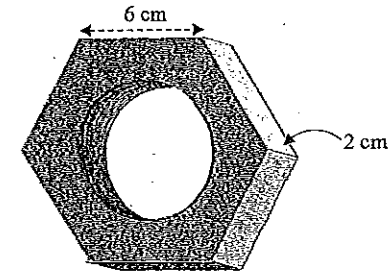
Each edge of the hexagon surfaces is 6 cm long and the nut has a thickness of 2 cm.

Ignoring the circular threaded section, what is the total area (in square centimetres) of the surfaces of the nut?

(A)   72   (B)   166   (C)   188   (D)   260

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15   What fraction of this 4 × 4 square is shaded with the trapezium?
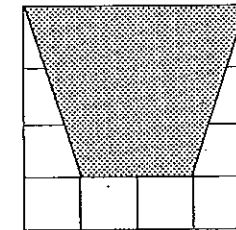
(A) $\frac{9}{16}$ (B) $\frac{7}{16}$ (C) $\frac{1}{2}$ (D) $\frac{3}{4}$

---

16   $k^{-2} =$

(A) $\frac{1}{k^2}$ (B) $-2k$ (C) $\frac{k}{2}$ (D) $\frac{-2}{k}$

17 A formula for calculating the size of each angle in a regular polygon is:

$$\frac{180(n-2)}{n}$$

where n is the number of sides in the polygon.

Janet calculated each angle in a regular polygon to be 135°.

What was the name of the polygon Janet was working with?

(A) Octagon   (B) Hexagon   (C) Pentagon   (D) Decagon

18 This shape has a vertical axis of symmetry, as shown.

12 cm   16 cm

6 cm
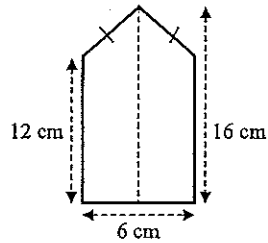
What is the perimeter (in centimetres) of the shape?

(A) 36   (B) 40   (C) 44   (D) 48

19 Which of the following has a factor of $b - 4$?

(A) $2b - 4$ (B) $-2b + 8$ (C) $b^2 + 16$ (D) $2b^2 - 4b$

20 In this triangle, which expression gives the value of Tan B + Sin A?
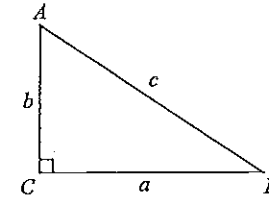
(A) $\frac{a+b}{a+c}$ (B) $\frac{a^2 + bc}{ac}$ (C) $\frac{b+c}{ac}$ (D) $\frac{a^2+bc}{a+c}$

Section II

60 marks
Attempt Questions 21–25
Allow about 1 hour for this section

Answer the questions in the spaces provided.

All necessary working should be shown in every question (except Question 21).

Question 21 (12 marks)   **Marks**

Working is not required to be shown in this question.

(a) What is the value of $(2^3)^2$?   1

....

(b) Evan begins walking around a fitness track at 9:30 am at a constant speed of 2.4 km/hr. Evan completes his walk at 10:45 am.

How far did Evan walk?   1

....

(c) A jar has only red, white and green coloured beads. The probability that a red bead will be randomly selected from the jar is $\frac{3}{8}$ and the probability that a white bead will be selected is $\frac{1}{5}$.

What is the probability that a green bead will be selected at random from the bag?   1

....

Question 21 (continued)   Marks

(d) What is the area (to the nearest square centimetre) of the shaded section between these two concentric circles?   1

....

....
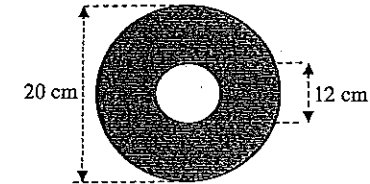
(e) Janice received a commission of $490 for selling a company's products during June.

If this is 8% of her total sales, what was the value of her sales in June.   1

....

(f) Simplify $(3a)^2 - 2a^2$.   1

....

(g) The compliment of an angle is $42°$.

What is the supplement of the angle?   1

....

(h) Simplify $-4(3w + 1) + 5w$.   1

....

Question 21 (continued)   Marks

(i)   The volume of this cylindrical block is 320π cm^3.

20 cm
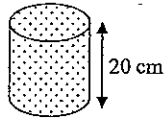
Calculate the radius of the block.   1.

....

(j)   Selina has an average of 3 goals per game after having played 5 games.

How many goals does Selina need to score on her 6'th game to increase her average
to 4 goals per game?   1

....

(k)   Town A is South East of town B.

In which direction is town B from town A?   1

....

(l)   The first 4 numbers in a pattern are 6, 9, 12, 15.

What is the 150'th number in the pattern?   1

....

End of Question 21

12

Question 22 (12 marks)   Marks

(a)   The graph shows the changing quantity of water in a tank (originally full) over a
       period of 6 months.

Volume of water in a tank
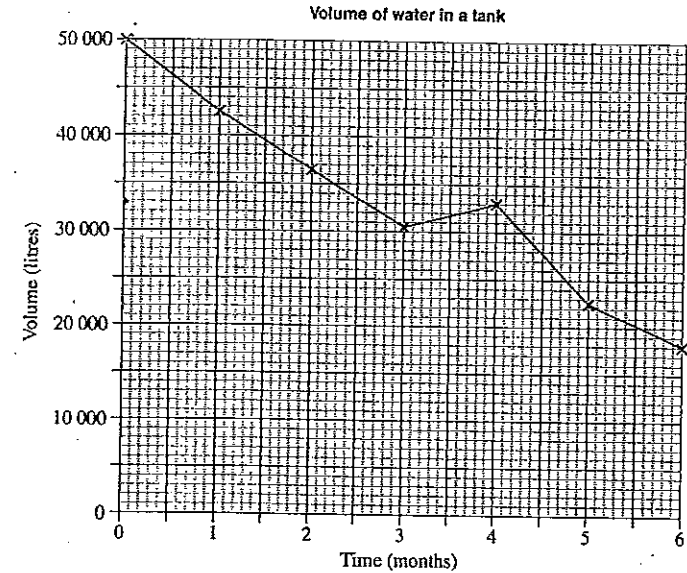
(i)   What is the full capacity of the tank?   1

....

(ii)   During which month did the water level in the tank increase?   1

....

(iii) During which month did the largest decrease in the water level occur?   1

....

(iv)   What was the average percentage loss of water per month from the tank during
       the first 3 months?   2

....

....

Question 22 continues on the next page

13

Question 22 (continued)   Marks

(b)   Gerry purchased a high definition television for a cash price of $4850.

       He paid a deposit of 15% and was required to make monthly payments for the balance
       owed, plus simple interest at a rate of 12% p.a. over a period of 3 years.

       (i)   Calculate the deposit Gerry paid.   1

       ....

       (ii)   What was the balance owed after paying the deposit?   1

       ....

       (iii) Using the formula:

       $$I = \frac{P \times r \times T}{100}$$

       Calculate the interest (to the nearest dollar) Gerry was charged on his purchase.   2

       ....

       ....

       ....

       (iv)   Calculate the amount (to the nearest dollar) Gerry was required to pay each
              month over the 3 years.   2

       ....

       ....

       (v)   What was the total amount Gerry paid for his television?   1

       ....

       ....

End of Question 22

14

Question 23 (12 marks)   Marks

(a)   Data is recorded in this frequency table.

Score	Cumulative Frequency
4	6
5	9
8	10
9	12
10	16

       (i)   What is the range of the data?   1

       ....

       (ii)   How many scores are recorded?   1

       ....

       (iii) Which score represents the mode of the data?   1

       ....

       ....

       (iv)   What is the median score?   1

       ....

       (v)   What percentage of scores are greater than 8?   2

       ....

       ....

       (vi)   Calculate the mean (correct to 2 decimal places) of the data.   2

       ....

       ....

       ....

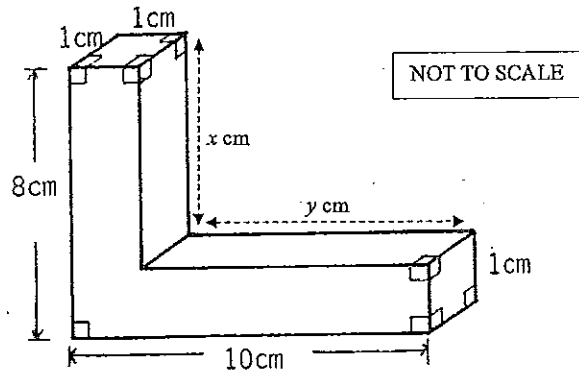**Question 23 continues on the next page**

15

Question 23 (continued)   **Marks**

(b)   An "L" shaped wooden prism block is shown below.

NOT TO SCALE

(i)   Calculate the values of x and y.   2

x: ....

y: ....

(ii)   Calculate the volume of the block.   2

....

....

....
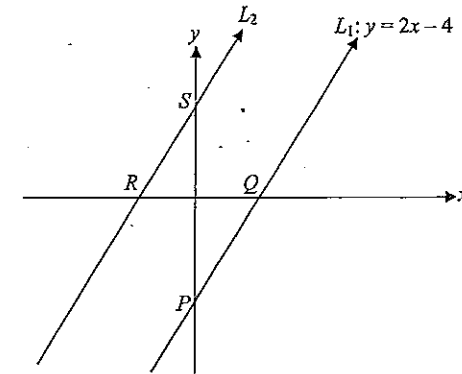
End of Question 23

Question 24 (12 marks)   **Marks**

(a)   The diagram shows the line L_1 with equation $y = 2x - 4$ and the line L_2, parallel to L_1.

The points P and Q are where the line L_1 intersects the axes and the points R and S are where the line L_2 intersects the axes.

(i)   Write down the co-ordinates of the points P and Q.   2

P: ....

Q: ....

(ii)   What is the gradient of the line L_1?   1

....

(iii) The point S has co-ordinates $(0, 3)$.

What is the equation of the line L_2?   2

....

(iv)   What is the length of the line RQ?   2

....

Question 24 continues on the next page

Question 24 (continued)

Marks

(b) Simplify each of the following:

   (i) $5m^3 - 2n^2 - m^3 + n^2$

   1

....

   (ii) $\dfrac{24p^6 q^{10}}{8p^2 q^5}$

   2

....

....

   (iii) $\dfrac{4k-16}{2k^2-8k}$

   2

....

....

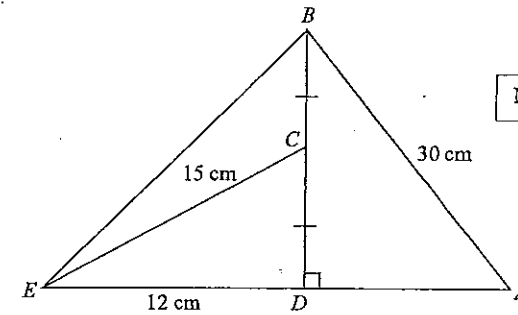**End of Question 24**

Question 25 (12 marks)

Marks

(a) The diagram shows three triangles *ABD*, *BCE* and *CDE*, with the point *C* the midpoint of *BD*.

NOT TO SCALE

$CE = 15$ cm, $DE = 12$ cm and $AB = 30$ cm.

   (i)   Calculate the size of angle *CED* to the nearest degree.

   2

....

....

....

   (ii) What is the size of angle *BCE*?

   2

....

....

   (iii) Calculate the length of *BD*.

   2

....

....

   (iv) Explain why triangles *ABD* and *ECD* are similar.

   1

....

....
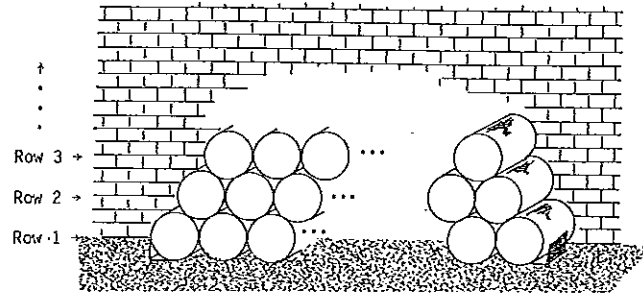
Question 25 continues on the next page

Question 25 (continued)   Marks

(b) The diagram shows identical cylindrical drums stacked against a brick wall in rows.

There are D drums in Row 1 and each row above has one less drum than the row underneath. Some of these drums are shown in the diagram.

(i) How many drums in row 2?   1

....

(ii) How many drums in row 5?   1

....

(iii) How many drums in row N?   1

....

(iv) There are 90 drums altogether in the first 5 rows.

By writing an an equation for D, calculate the number drums in the bottom row.   2

....

....

End of paper

20

SECTION 1

Question	1	2	3	4	5	6	7	8	9	10
Solution	D	C	A	C	B	C	B	D	C	A
Performance Band	3	3	3	3	3	4	4	3	4	4

Question	11	12	13	14	15	16	17	18	19	20
Solution	C	D	C	D	A	A	A	B	B	B
Performance Band	4	4	4	4	5	5	5	6	6	6

SECTION 2

Question	Marks	Performance Band	Suggested Solution
21(a)	1	2	$2^3 \times 2^3 = 2^6 = 64$
(b)	1	3	Time taken was 1.25 hours Distance $= 2.4 \times 1.25$ $= 3$ km
(c)	1	3	$1 - (\frac{3}{8} + \frac{1}{5})$ $= \frac{17}{40}$
(d)	1	3	Area $= \pi(10)^2 - \pi(6)^2$ $= 64\pi$ $= 201$ cm^2
(e)	1	3	Total sales $= \frac{490}{8} \times 100$ $= \$6125$
(f)	1	4	$(3a)^2 - 2a^2 = 7a^2$
(g)	1	4	The angle is $90° - 42° = 48°$ The supplement is $180° - 48°$ $= 132°$
(h)	1	4	$-12w - 4 + 5w$ $= -7w - 4$
(i)	1	5	$V = \pi \times r^2 \times h$ $320\pi = \pi \times r^2 \times 20$ $16 = r^2$ $r = 4$
(j)	1	5	Total goals scored in 5 games is 15 For 6 games, total goals scored is 24 So $24 - 15 = 9$ goals must be scored in the 6'th game

Question 21 continues on the next page

Question 21 continued

Question	Marks	Performance Band	Suggested Solution
(k)	1	5	The direction is NW
(l)	1	6	A: 1 2 3 4 / B: 6 9 12 15 / $B = 3A + 3$ / Let $A = 150$ / So $B = 3(150) + 3$ / $= 453$ (150'th number)

Question	Marks	Performance Band	Suggested Solution
22(a)(i)	1	2	50 000 L
(ii)	1	2	4'th month
(iii)	1	2	5'th month
(iv)	1 / 1	4	Month 1 2 3 / Loss (L) 7500 6000 6000 / Average loss $= (7500 + 6000 + 6000) \div 3$ / $= 6500$ L/month
(b)(i)	1	3	$0.15 \times \$4850 = \$727.50$
(ii)	1	3	$\$4850 - \$727.50 = \$4122.50$
(iii)	1 / 1	3	$I = \dfrac{\$4122.50 \times 12 \times 3}{100}$ / $= \$1484$ (nearest dollar)
(iv)	1 / 1	4	Amount to repay $= \$4122.50 + \$1484$ / $= \$5606.50$ / Pay each month $= \$5606.50 \div 36$ / $= \$156$ (nearest dollar)
(v)	1	4	Total paid = Deposit + Repayments / $= \$727.50 + \$5606.50$ / $= \$6334$

Question	Marks	Performance Band	Suggested Solution
23(a)(i)	1	2	$10 - 4 = 6$
(ii)	1	3	16
(iii)	1	4	4
(iv)	1	4	8'th and 9'th scores are both 5 / So Median = 5
(v)	1 / 1	5	Frequency of score 9 is 2 / Frequency of score 10 is 4 / There are 6 scores greater than 8 / % is $\dfrac{6}{16} \times 100$ / $= 37.5\%$
(vi)	1 / 1	5	$[(6 \times 4) + (3 \times 5) + (1 \times 8) + (2 \times 9) + (4 \times 10)]$ / $\div 16$ / $= 6.56$ (2 decimal places)
(b)(i)	1 / 1	2	$x = 8 - 1 = 7$ / $y = 10 - 1 = 9$
(ii)	1 / 1	5	$V = [(8 \times 10) - (7 \times 9)] \times 1$ / $= 17$ cm^3 / (or alternative methods)

Question	Marks	Performance Band	Suggested Solution
24(a)(i)	2	4	$P: (0, -4)$, $Q: (2, 0)$
(ii)	1	3	2
(iii)	2	4	$y = 2x + 3$
(iv)	1 / 1	5	R is where $y = 0$ in $y = 2x + 3$ / So $x = -1.5$ / R has co-ordinates $(-1.5, 0)$ / Hence RQ has length $1.5 + 2$ / $= 3.5$
(b)(i)	1	4	$4m^3 - n^2$
(ii)	2	4	$3p^4 q^5$
(iii)	1 / 1	5	$\dfrac{4(k-4)}{2k(k-4)} = \dfrac{4}{2k} = \dfrac{2}{k}$

Question	Marks	Performance Band	Suggested Solution
25(a)(i)	1 1	4	$\text{Cos} \angle CED = \frac{12}{15}$ $\angle CED = 37°$ (nearest degree)
(ii)	1 1	4	$\angle DCE = 90° - 37° = 53°$ $\angle BCE = 180° - 53°$ $= 127°$
(iii)	1 1	5	$CD^2 = 15^2 - 12^2$ $= 81$ $CD = 9$ So $BD = 18$
(iv)	1	5	Since $\frac{AB}{CE} = \frac{BD}{CD} = \frac{2}{1}$ The ratio of corresponding sides is equal So the triangles are similar (Note: Students may also mention that all angles are correspondingly equal in both triangles as an alternate solution)
(b)(i)	1	5	Row 2 has D − 1 drum
(ii)	1	5	Row 3: D − 2 drums Row 4: D − 3 drums Row 5: D − 4 drums
(iii)	1	6	Row N: D − (N − 1) = D − N + 1 drums
(iv)	1 1	6	D + (D − 1) + (D − 2) + (D − 3) + (D − 4) = 90 5D − 10 = 90 D = 20 (Row 1 has 20 drums)