NORTH SYDNEY BOYS
H I G H   S C H O O L

STAGE 5.1-5.3 MATHEMATICS
2011 Year 10 Final Examination

General instructions

- Working time – 120 minutes.

- Marks may be deducted for careless or poorly arranged work.

- Commence each new question on a new sheet.

- Write using blue or black pen. Where diagrams are to be sketched, these may be done in pencil.

- Board approved calculators may be used.

- All necessary working should be shown in every question.

- Attempt **all** questions.

- At the conclusion of the examination, bundle the sheets used in the correct order within this paper and hand to examination supervisors.

Class (please ✔)

- ◯ 10M1 – Ms Ziaziaris/Mr Ireland

- ◯ 10M2 – Mr Lam/Mr Lin

- ◯ 10M3 – Mr Berry/Mr Ireland

- ◯ 10M4 – Mr Lowe/Mr Fletcher

- ◯ 10M5 – Ms Everingham/Mr Lin

NAME: . . . .   **# SHEETS USED**: . . . .

Marker's use only.

QUESTION	1	2	3	4	5	6	7	8	9	10	Total	%
MARKS	16	14	12	11	11	13	13	7	11	12	120	

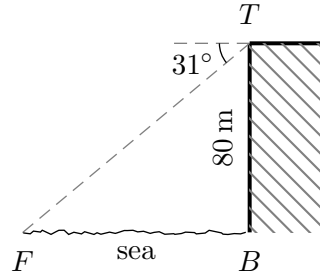**Question 1**   (16 Marks)   Commence a NEW page.   **Marks**
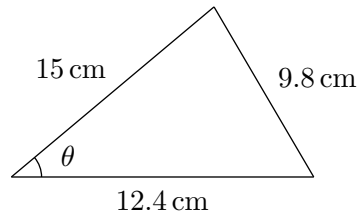
(a)   In the sketch below, the angle of depression of a fishing boat F from the top T of   **2**
a 80 m high vertical cliff TB is $31°$.

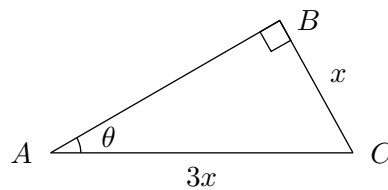Copy or trace the diagram on to your answer sheet.

Calculate the distance FB from the fishing boat to the base of the cliff.

(b)   Refer to the diagram for this question.

    i.   Calculate, to the nearest degree, the value of θ.   **2**

   ii.   Calculate the area of the triangle.   **2**

(c)   If A is an obtuse angle and $\sin A = \frac{5}{12}$, find the exact value of $\tan A$ and $\cos A$.   **3**

(d) $\angle ABC$ is a right angle. Find the size of θ to the nearest minute.   **2**

Question 1 continued on the next page . . .

Question 1 continued from the previous page ...

(e) Joelle sets out from her base camp at A on a bearing of 027° for 24 km to point B where she makes her camp.
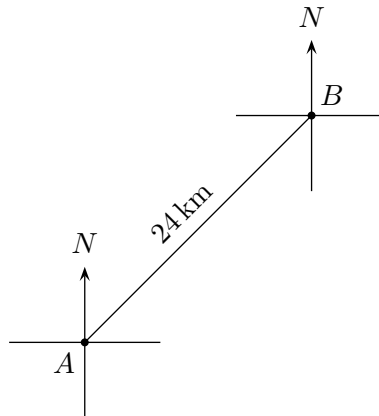
Reproduce this diagram on to your answer sheets.

  i. How far due east of base camp A is Joelle when she reaches point B? Give your answer correct to 1 decimal place.   **1**

  ii. The next day Joelle sets out from Point B on a bearing of 100° for 15 km to point C.   **1**

     Explain why $\angle ABC = 107°$.

  iii. What is the length of the direct route from point C back to base camp at A? Give your answer correct to the nearest kilometre.   **3**

Question 2   (14 Marks)   Commence a NEW page.   **Marks**

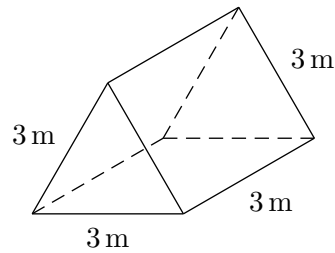(a) Simplify fully $\sqrt{32} - \sqrt{18} + \sqrt{2}$.   **2**

(b) Expand and simplify fully $\left(\sqrt{5} - 1\right)^2$.   **2**

(c) Find b if $\sqrt{12} + \sqrt{3} = \sqrt{b}$.   **2**

(d) If $x = \sqrt{3} + 1$, express $x - \dfrac{1}{x}$ in its simplest form with a rational denominator.   **3**

(e) Factorise $3x^2 + x - 2$.   **2**

(f) Solve the quadratic equation $x^2 - 6x - 6 = 0$, giving your answer in exact form.   **3**
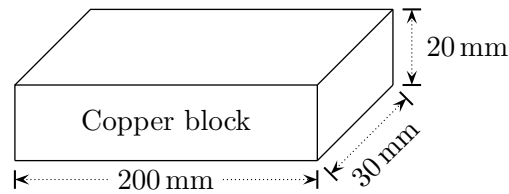
**Question 3**   (12 Marks)   Commence a NEW page.   **Marks**

(a)   Calculate the total surface area of the prism, correct to 3 significant figures.   **4**

(b)   A solid copper block in the shape of a rectangular prism has dimensions $20\,\mathrm{mm}$, $30\,\mathrm{mm}$ and $200\,\mathrm{mm}$.

   i.   Find its volume in cubic millimetres.   **2**

   ii. The solid copper block is melted, and all of the copper is used to make a   **2**
        hollow cylindrical pipe of outer diameter $14\,\mathrm{mm}$, inner diameter $10\,\mathrm{mm}$ and
        length x mm.
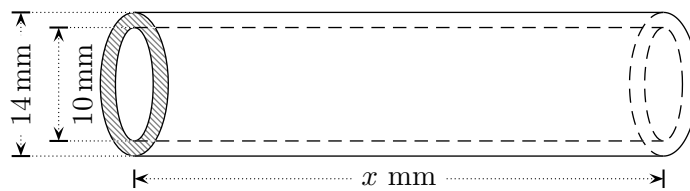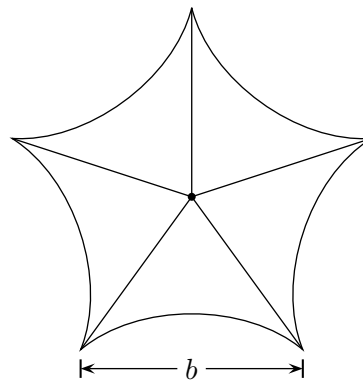

        Show that the volume V mm^3, of the copper in this pipe is given by $V = 24\pi x$.

   iii. Find x, the length of the pipe. Answer correct to the nearest millimetre.   **2**

(c)   Two umbrellas are similar shapes with $a : b = 4 : 5$. The standard model requires   **2**
      $1.44\,\mathrm{m}^2$ of material. How much material is required for the deluxe model?
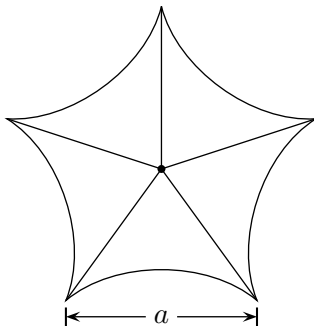
Question 4   (11 Marks)   Commence a NEW page.   **Marks**

(a)   The tax payable on taxable incomes in the range $30 001 to $45 000 is given by   **1**

$5 400 plus 40c for each $1 over $30 000

How much tax does Mrs Collins pay if her taxable income is $42 408?

(b)   Bicycles depreciate at the rate of 15% p.a. Mr Lam buys a bicycle for $1 400 in   **3**
January 2011. How much will his bicycle be worth in January 2020?

(c)   Ms Everingham borrowed $70 000 at 8% p.a. for 15 years.   **2**

Monthly loan repayments per $1 000 borrowed				
Rate (p.a.)	5 years	10 years	15 years	20 years
5%	$18.87	$10.61	$7.91	$6.60
6%	$19.33	$11.10	$8.44	$7.16
7%	$19.80	$11.61	$8.99	$7.75
8%	$20.28	$12.13	$9.56	$8.36
9%	$20.76	$12.67	$10.14	$9.00

What is her monthly loan repayment?

(d)   Mr Berry was previously employed as a salesman, and he was offered two methods
of calculating his income.

Method 1	Commission only of 13% of all sales.
Method 2	$350 per week plus commission of 4.5% of all sales

Mr Berry's research determines that each salesperson sells on average, $15 670
worth of products each month.

   i.   Based on his research, how much would Mr Berry earn in a year if he were   **1**
to choose Method 1?

   ii.   If Mr Berry was to choose a method of payment based on the average sales   **2**
figures, state which method he should choose in order to earn the greater
income. Justify your answer with appropriate calculations. (Use 52 weeks
per year)

(e)   Ms Ziaziaris and Mr Fletcher put the same amount of money into different   **2**
investments for one year. Ms Ziaziaris' investments *increased* by 8%, whilst
Mr Fletcher's investments *decreased* by 7%. The difference in value of their
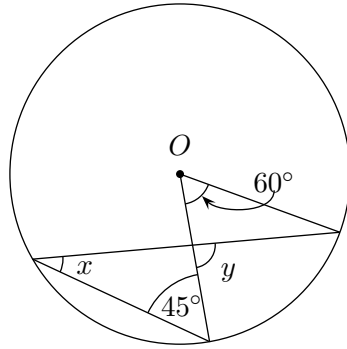investments was $750 after 1 year.

What was the original amount of money that each of them invested?
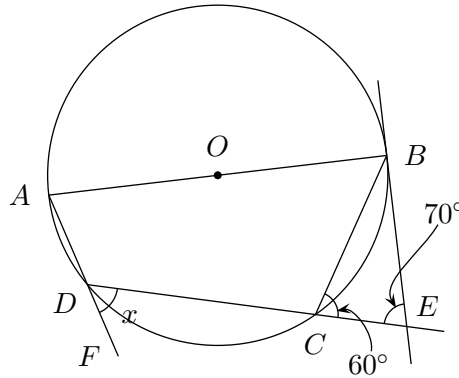
Question 5   (11 Marks)   Commence a NEW page.   **Marks**

(a) O is the centre of the circle. Find the value of x and y.   **2**
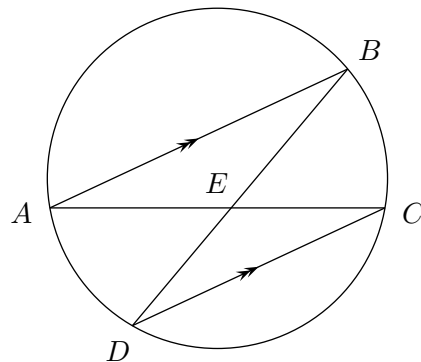
(b) O is the centre of the circle. Find the value of each of the following, giving reasons.

    i. $\angle OBE$.   **2**

    ii. $\angle OBC$.   **2**

    iii. x.   **2**

(c) A, B, C, D are points on the circumference of the circle as shown. AC and BD **3**
intersect at E. $AB \parallel DC$.

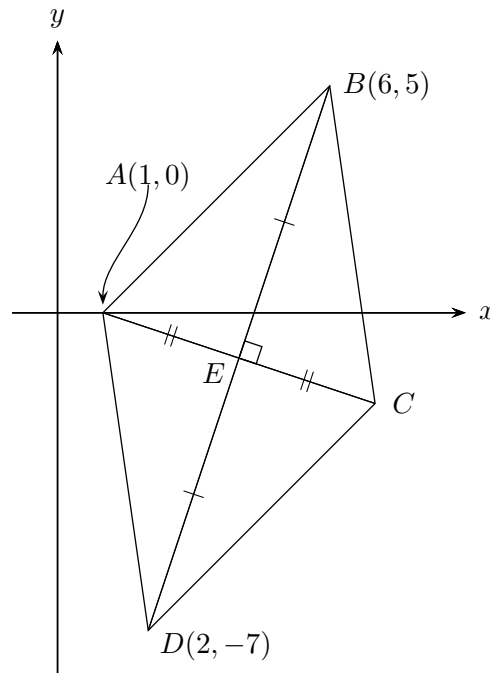Prove that $AE = BE$.

Question 6   (13 Marks)   Commence a NEW page.   **Marks**

(a) A, B, C and D are the vertices of a rhombus.

     i.   Find the exact length of AB.   **2**

    ii.   Find the gradient of AB.   **2**

   iii.   The point of intersection of the diagonals is E. Find the coordinates of E.   **2**

   iv.   Show the equation of the line BD is $y = 3x - 13$.   **2**

    v.   Find the gradient of a line perpendicular to BD.   **1**

   vi.   Find the equation of the diagonal AC **2**

(b)   The equation of the line shown on this graph is of the form $y = mx + b$. If the line   **2**
crosses the x axis between -3 and -1, and crosses the y axis between -1.5 and
-2, what are the possible values of m?
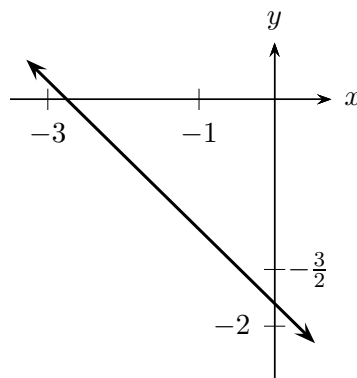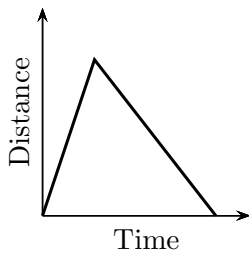
Question 7   (13 Marks)   Commence a NEW page.   **Marks**
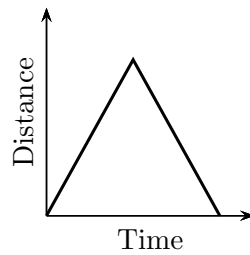
(a)   On separate axes for each, sketch the following functions, clearly showing all essential features.

     i. $y = x^2 - 2x - 8$, showing all intercepts and the coordinates of the vertex.   **3**

     ii. $y = 2\cos x$, $0° \leq x \leq 360°$.   **2**

     iii. $y = \dfrac{3}{x}$.   **2**

(b)   A cyclist travels up a hill, turns around and travels back down the hill.   **1**
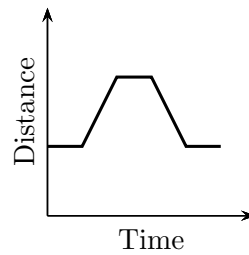Which graph best represents this journey?

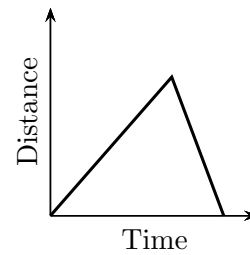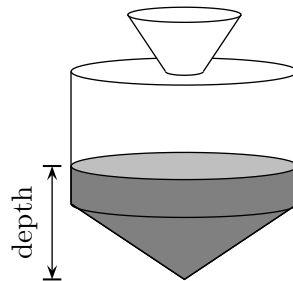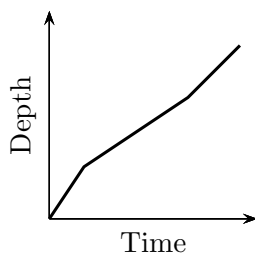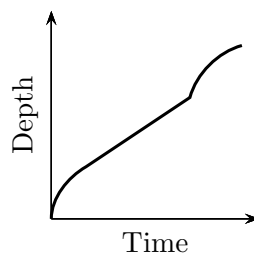(A)   (B)   (C)   (D)

(c)   The container shows a wheat container being *filled* at a constant rate.   **1**
Which graph best illustrates the depth of wheat as the container is being filled?
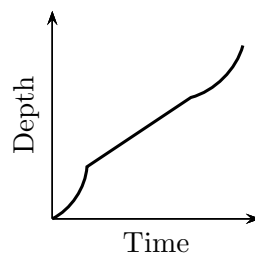

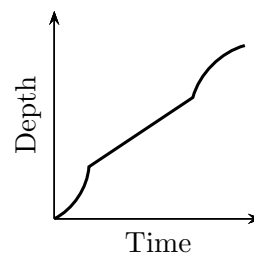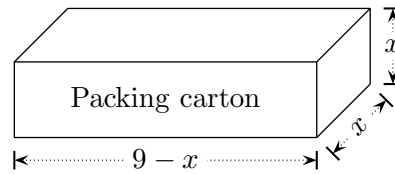(A)   (B)   (C)   (D)

Question 7 continued on the next page . . .

Question 7 continued from the previous page ...

(d)   A packing carton is to be constructed as shown in the diagram. All dimensions are in centimetres.

i.   Show that the surface area S of the carton is $S = 36x - 2x^2$.   **1**

ii.   Explain why the formula is only valid for values of x from $x = 0$ to $x = 9$.   **1**

iii.   The diagram below shows the graph of the volume of the carton for values   **1**
of x from $x = 0$ to $x = 9$. The dimensions of the carton are chosen such that its volume is a maximum.
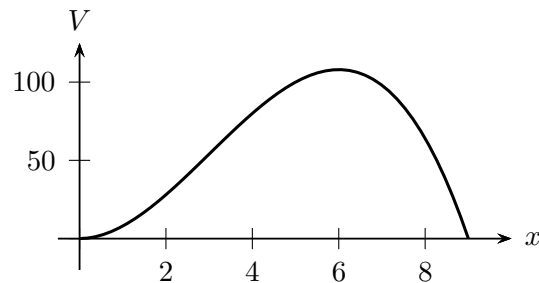

By examining the graph, find the value for the carton has the maximum volume.

iv.   Find the surface area of the carton when it has maximum volume.   **1**

Question 8   (7 Marks)   Commence a NEW page.   **Marks**

(a)   A card is drawn from a standard pack of playing cards.   **1**
      What is the probability that it is a jack or king?

(b)   A die is made in the form of a tetrahedron (triangular pyramid). The net of the
      die is shown below.
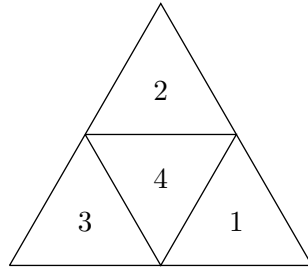
      The faces are numbered 1, 2, 3, and 4. The die is rolled twice.

      The number on the face that the die lands on is recorded each time.

      i.   Draw a suitable diagram to represent the possible outcomes.   **1**

      ii. Find the probability that the sum of the two recorded numbers is 4.   **1**

(c)   At a particular school, the probability that a student travels to school by bus is
      0.4, while the probability that a student wears the correct uniform is 0.8.

      i.   Draw a probability tree to represent the possible outcomes if a student from   **2**
           the school is selected at random.

      ii. Find the probability that the student does *not* catch a bus but is in correct   **2**
           uniform.

**Question 9**   (11 Marks)   Commence a NEW page.   **Marks**

(a)   The mean of this set of scores is 5. If another score 5 is added to the set, which of   **1**
      these measures will change?

Score	f
2	2
3	3
4	1
5	4
6	7
7	3
$\sum$	20

- mean
- mode
- median
- range

(b)   In a normally distributed set of scores, the mean is 23 and the standard deviation   **1**
      is 5. Approximately what percentage of scores will lie between 18 and 33?

(c)   The heights of all 60 members of a choir were recorded. The results were grouped
      and displayed as a cumulative frequency histogram and polygon as shown.

Height of choir members
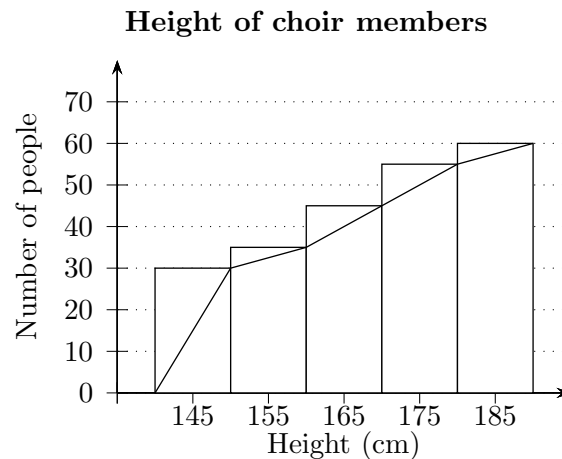
The shortest person in the choir is 140 cm and tallest is 190 cm.

   i.   Use the graph to find the median of the distribution.   **1**

   ii. Use the graph to find the upper and lower quartiles.   **2**

   iii. Draw an accurate box and whisker plot to represent the data.   **2**

(d)   Students in class X scored the following marks in their yearly maths exam.

$$72 \quad 68 \quad 80 \quad 77 \quad 76 \quad 69 \quad 82 \quad 74 \quad 85$$
$$61 \quad 73 \quad 78 \quad 72 \quad 76 \quad 67 \quad 80 \quad 73 \quad 68$$

   i.   Find the mean and standard deviation σ_n for this set of scores, correct to 2   **2**
        decimal places.

   ii. Class Y did the same exam. The mean for class Y was 75.23 and standard
        deviation was 5.78.

        (A)   Which class had the more consistent results?   **1**

        (B)   Which class performed better on the exam?   **1**

Question 10   (12 Marks)   Commence a NEW page.   **Marks**

(a)   If $g(x) = 6 - 4x$, find

    i. $g(5)$.   **1**

    ii. $g\left(\frac{1}{2}x\right)$.   **1**

    iii. $g^{-1}(x)$.   **1**

(b)   i.   Sketch $f(x) = 2^x$, showing all important features.   **2**

    ii.   State the permissible values of x and the permissible values of y.   **2**

    iii.   Is $f(x) = 2^x$ a function? Justify your answer.   **1**

    iv.   On the same set of axes as part (i), sketch $y = f^{-1}(x)$.   **2**
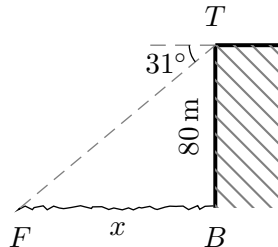
    v.   Sketch $y = f(x) - 3$, showing all essential features.   **2**

End of paper.

Suggested Solutions

Question 1

(a)   (2 marks)

   ✓   [1] for correct tan ratio.
   ✓   [1] for final answer.

$$\tan 31° = \frac{80}{FB}$$

$$FB = \frac{80}{\tan 31°} = 133.14\,\text{m} \ (2\ \text{d.p.})$$

(b)   i.   (2 marks)
   ✓   [1] for correct cos rule.
   ✓   [1] for final answer.

$$\cos \theta = \frac{15^2 + 12.4^2 - 9.8^2}{2 \times 15 \times 12.4}$$
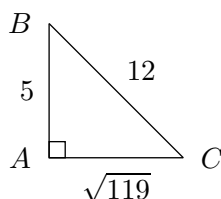$$\theta = 40°32' \approx 41°$$

   ii.   (2 marks)
   ✓   [1] for correct area of $\triangle$ via sine formula.
   ✓   [1] for final answer.

$$A = \frac{1}{2} \times 15 \times 12.4 \times \sin 41°$$
$$= 61.01\,\text{m} \ (2\ \text{d.p.})$$

(c)   (3 marks)

   ✓   [1] for correct quadrant.
   ✓   [1] for finding missing side.
   ✓   [1] for final answer.

As $90° \leq A \leq 180°$, then $\cos A$ and $\tan A < 0$.

$$12^2 = AC^2 + 5^2$$
$$AC = \sqrt{119}$$

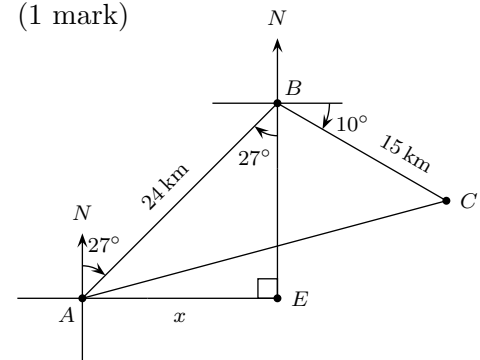$$\therefore \tan A = -\frac{5}{\sqrt{119}} \qquad \cos A = -\frac{\sqrt{119}}{12}$$

(d)   (2 marks)

   ✓   [1] for correct sin ratio.
   ✓   [1] for final answer.

$$\sin \theta = \frac{\not{x}}{3\not{x}} = \frac{1}{3}$$
$$\therefore \theta = 19°28'$$

(e)   i.   (1 mark)

$$\sin 27° = \frac{x}{24}$$
$$x = 24 \sin 27° = 10.9\,\text{km}$$

   ii.   (1 mark)
   • $\angle ABE = 27°$
     (alternate $\angle$ on $\parallel$ lines)
   • $\angle CBE = 80°$
     (complementary $\angle$)
   • $\therefore \angle ABC = 80° + 27° = 107°$.

   iii.   (3 marks)
   ✓   [1] for correct cos rule.
   ✓   [1] for correct AC^2.
   ✓   [1] for final answer.

$$AC^2 = 24^2 + 15^2 - 2(24)(15)\cos 107°$$
$$= 1\,011.507 \cdots$$
$$\therefore AC = 31.8\,\text{km} \cdots \approx 32\,\text{km}$$

Question 2

(a)   (2 marks)

    ✓   [1] for simplifying all surds.

    ✓   [1] for final answer.

$$\sqrt{32} - \sqrt{18} + \sqrt{2} = 4\sqrt{2} - 3\sqrt{2} + \sqrt{2}$$
$$= 2\sqrt{2}$$

(b)   (2 marks)

    ✓   [−1] for each error.

$$\left(\sqrt{5} - 1\right)^2 = \left(\sqrt{5} - 1\right)\left(\sqrt{5} - 1\right)$$
$$= 5 - 2\sqrt{5} + 1$$
$$= 6 - 2\sqrt{5}$$

(c)   (2 marks)

    ✓   [1] for simplifying the surd expression.

    ✓   [1] for b.

$$\sqrt{12} + \sqrt{3} = 2\sqrt{3} + \sqrt{3}$$
$$= 3\sqrt{3} = \sqrt{27}$$
$$\equiv \sqrt{b}$$
$$\therefore b = 27$$

(d)   (3 marks)

    ✓   [−1] for each error.

$$\sqrt{3} + 1 - \frac{1}{\sqrt{3} + 1} {\scriptstyle \times \sqrt{3} - 1 \atop \times \sqrt{3} - 1}$$
$$= \sqrt{3} + 1 - \frac{\left(\sqrt{3} - 1\right)}{3 - 1}$$
$$= \frac{2\left(\sqrt{3} + 1\right) - \left(\sqrt{3} - 1\right)}{2}$$
$$= \frac{\sqrt{3} + 3}{2}$$

(e)   (2 marks)

    ✓   [1] for each correct root.
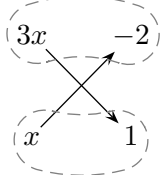
$$3x^2 + x - 2$$
$$= (3x - 2)(x + 1)$$

(f)   (3 marks)
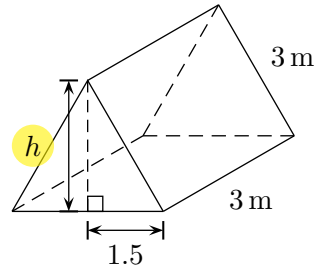
    ✓   [1] for correct method.

    ✓   [1] for each correct root.

$$x^2 - 6x - 6 = 0$$
$$x = \frac{6 \pm \sqrt{6^2 - 4(1)(-6)}}{2} = \frac{6 \pm \sqrt{60}}{2}$$
$$= \frac{6 \pm 2\sqrt{15}}{2} = 3 \pm \sqrt{15}$$

Question 3

(a)   (4 marks)

    ✓   [1] for finding h.

    ✓   [1] for each of A_{front}, A_{side}, A_{total}.

$$h^2 + 1.5^2 = 3^2$$
$$h^2 = 6.75 = \frac{27}{4}$$
$$h = \frac{3\sqrt{3}}{2}$$

- Front/back:

$$A_{\text{front}} = \frac{1}{2}bh = \frac{1}{2} \times 3 \times \frac{3\sqrt{3}}{2}$$
$$= \frac{9\sqrt{3}}{4}$$

- Sides/base: $A_{\text{side}} = 3 \times 3 = 9$
- Total:

$$A_{\text{total}} = (2 \times A_{\text{front}}) + (3 \times A_{\text{side}})$$
$$= \frac{9\sqrt{3}}{2} + 27 = 34.8\,\text{m}^2 \ (3 \text{ s.f.})$$

(b)   i.   (2 marks)

   ✓   [1] for 120 000

   ✓   [1] for correct units.

$$V = 200 \times 30 \times 20 = 120\,000\,\text{mm}^3$$

   ii.   (2 marks)

   ✓   [1] for correct volume formula (or subtraction of volumes)

   ✓   [1] for final answer.

$$V = \pi R^2 h - \pi r^2 h = \pi h(R^2 - r^2)$$
$$= \pi \times x \times (7^2 - 5^2) = 24\pi x$$

  iii.   (2 marks)

   ✓   [−1] for each error.

$$24\pi x = 120\,000$$
$$x = \frac{120\,000}{24\pi} = 1\,592\,\text{mm}$$

(c)   (2 marks)

   ✓   [1] for correct ratio of areas.

   ✓   [1] for final answer.

$$\frac{A_\text{deluxe}}{A_\text{standard}} = \frac{b^2}{a^2} = \frac{5^2}{4^2} = \frac{25}{16}$$
$$\frac{A_\text{deluxe}}{\underset{\times 1.44}{1.44}} = \frac{25}{\underset{\times 1.44}{16}}$$
$$A_\text{deluxe} = \frac{25 \times 1.44}{16} = 2.25\,\text{m}^2$$

Question 4

(a)   (1 mark)

$$\text{Marginal rate} = 0.4 \times (42\,408 - 30\,000)$$
$$= 0.4 \times 12\,408 = 4\,963.2$$
$$\text{Tax payable} = 5\,400 + 4\,963.2$$
$$= \$10\,363.2$$

(b)   (3 marks)

   ✓   [1] for correct formula.

   ✓   [1] for correct number of years.

   ✓   [1] for final answer.

$$S = V_0(1 - r)^n$$
$$= 1\,400(1 - 0.15)^9$$
$$= \$324.26$$

(c)   (2 marks)

Repayments per $1\,000$	
Rate (p.a.)	**15 years**
5%	$7.91
6%	$8.44
7%	$8.99
8%	$9.56
9%	$10.14

$$70 \times 9.56 = 669.2$$

(d)   i.   (1 mark)

$$0.13 \times 15\,670 \times 12 = \$24\,445.20$$

   ii.   (2 marks)

$$(350 \times 52) + (0.045 \times 15\,670 \times 12)$$
$$= \$26\,661.80$$

Method 2 earns more.

(e)   (2 marks)

   ✓   [−1] for each error.

Let x be the amount invested.

$$Z = 1.08x$$
$$F = 0.93x$$
$$1.08x - 0.93x = \$750$$
$$\underset{\div 0.15}{0.15x} = \underset{\div 0.15}{750}$$
$$x = \$5\,000$$

Question 5   In this question, highlighted text indicates answer + reason required.

(a)   (2 marks)

   ✓   [1] each for x and y. No reasons required.

  ● $x = 30°$

    ($\angle$ at the centre is twice $\angle$ at the circumference standing on the same arc).

  ● $y = 30° + 45° = 75°$ (ext $\angle$ of $\triangle$)

(b)   ✓   [1] for each correct final answer.

✓   [1] for each correct final reason.

    i.   (2 marks) $\angle OBE = 90°$
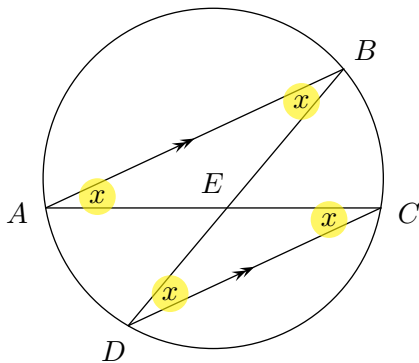
       ($\angle$ between the tangent & radius)

   ii.   (2 marks)

- $\angle CBE = 40°$

    ($\angle$ sum of $\triangle BCE$)

- $\therefore \angle OBC = 90° - 50° = 40°.$

  iii.   (2 marks) $x = 40°$

     (ext $\angle$ of cyclic quad
equals interior opposite $\angle$)

(c)   (3 marks)

✓   [1] for alternate $\angle$ on $\parallel$ lines (with reason).

✓   [1] for $\angle$ in the same segment standing on the same arc (with reason).

✓   [1] for $AE = BE$ as $\triangle ABC$ is isosceles (with reason).

- Let $\angle BAE = x$.
- $\angle ECD = x$
  (alternate $\angle$, $AB \parallel CD$)
- $\angle ECD = \angle ABE = x$
  ($\angle$ in the same segment standing on the same arc)
- $\therefore ABE$ is isosceles (2 equal $\angle$)
- $\therefore AE = BE$
  (equal $\angle$ are opposite equal sides)

Question 6

(a)   i.   (2 marks)

$$AB = \sqrt{(6-1)^2 + (5-0)^2}$$
$$= \sqrt{50} = 5\sqrt{2}$$

   ii.   (2 marks)

$$m_{AB} = \frac{5-0}{6-1} = \frac{5}{5} = 1$$

  iii.   (2 marks)

$$E = MP_{BD} = \left(\frac{6+2}{2}, \frac{5-7}{2}\right)$$
$$= (4, -1)$$

  iv.   (2 marks)

$$\frac{y-5}{x-6} = \frac{-7-5}{2-6} = \frac{-12}{-4} = 3$$
$$y - 5 = 3(x-6) = 3x - 18$$
$$_{+5}_{+5}$$
$$y = 3x - 13$$

   v.   (1 mark)

Gradient of line $\perp$ to BD is $-\frac{1}{3}$.

  vi.   (2 marks)

$$\frac{y-0}{x-1} = -\frac{1}{3}$$
$$y = -\frac{1}{3}x + \frac{1}{3}$$

(b)   (2 marks)

- Steepest gradient $= -\frac{2}{1} = -2$.
- Flattest gradient $= \frac{-\frac{3}{2}}{3} = -\frac{1}{2}$.

Hence $-2 < m < -\frac{1}{2}$.

Question 7

(a)   i.   (3 marks)

✓   [1] for shape.

✓   [1] for all correct intercepts.

✓   [1] for vertex.

$$y = x^2 - 2x - 8$$
$$= x^2 - 2x + 1 - 1 - 8$$
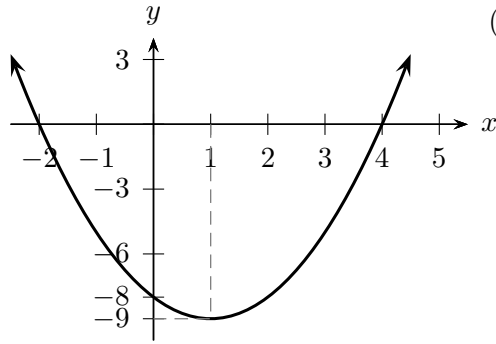$$= (x-1)^2 - 9$$
$$\therefore V(1, -9)$$

x intercepts:
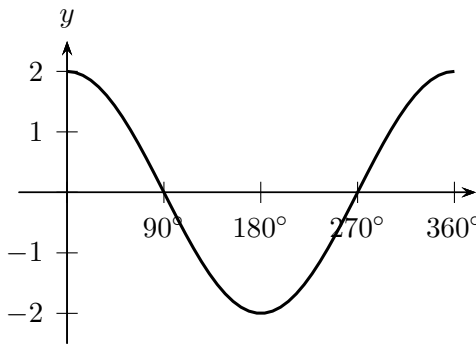
$$x^2 - 2x - 8 = 0$$
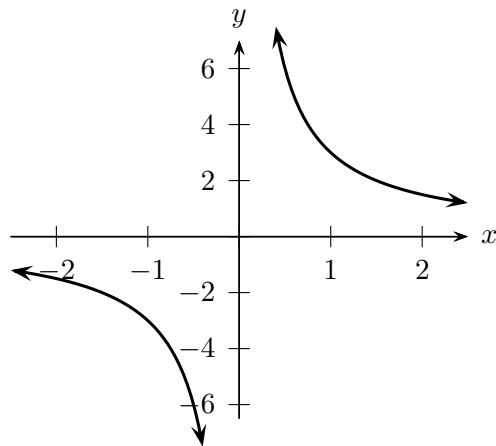$$(x-4)(x+2) = 0$$
$$x = 4, -2$$

ii. (2 marks)

- ✓ [1] for shape.
- ✓ [1] for amplitude.

iii. (2 marks)

- ✓ [1] for shape.
- ✓ [1] for points.

(b) (1 mark) – (D)

(c) (1 mark) – (B)

(d) i. (1 mark)

$$S = 2\Big[x(9-x) + x^2 + x(9-x)\Big]$$
$$= 4x(9-x) + 2x^2$$
$$= 36x - 4x^2 + 2x^2$$
$$= 36x - 2x^2$$

ii. (1 mark)
One dimension of the carton is $9-x$ and so

$$9 - x > 0$$
$$\therefore x < 9$$

iii. (1 mark) $x = 6$

iv. (1 mark)

$$S = 36(6) - 2(36) = 4 \times 36 = 144\,\text{m}^2$$

Question 8

(a) (1 mark)
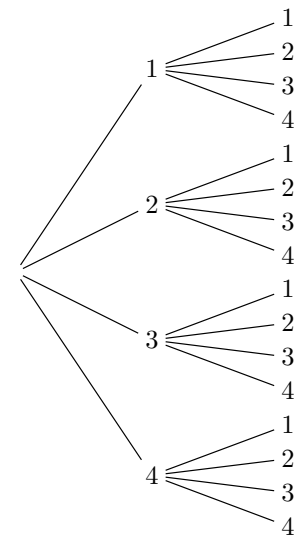
$$P(J \text{ or } K) = \frac{8}{52} = \frac{2}{13}$$

(b) i. (1 mark)

	1	2	3	4
1	11	12	⑬	14
2	21	㉒	23	24
3	㉛	32	33	34
4	41	42	43	44

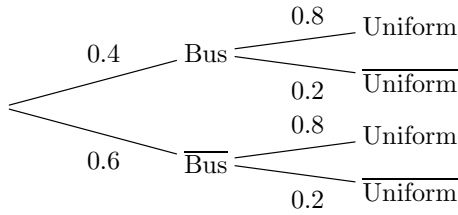or

ii. (1 mark)

$$P(\text{sum} = 4) = \frac{3}{16}$$

(c)   i.   (2 marks)

✓   [1] for each correct tree.

ii.   (2 marks)

$$P(\overline{B}, U) = 0.6 \times 0.8 = 0.48$$

Question 9

(a)   (1 mark) – median changes.

(b)   (1 mark)

$$\overline{x} = 23 \qquad \sigma = 5$$
$$\overline{x} - \sigma = 18 \qquad \overline{x} + 2\sigma = 33$$

z scores are -1 and 2 respectively.

$$P(-1 < z < 2) = \frac{1}{2}(0.68 + 0.95)$$
$$= 0.815 = 81.5\%$$

(c)   i.   (1 mark)

$$\tilde{x} = 150\,\text{cm}$$

ii.   (2 marks)

$$Q_1 = 145\,\text{cm} \qquad Q_3 = 170\,\text{cm}$$

iii.   (2 marks)

✓   [−1] for each error.

(d)   i.   (2 marks)

$$\overline{x} = 73.94 \qquad \sigma_n = 5.84$$

ii. (A)   (1 mark)

$$\overline{x} = 75.23 \qquad \sigma_n = 5.78$$

Class Y had more consistent results as σ_n is smaller.
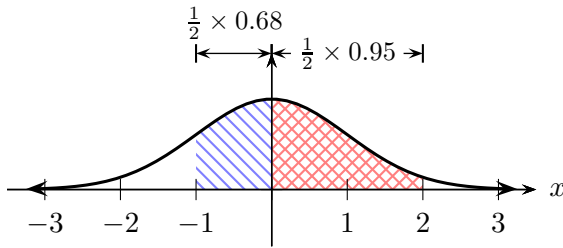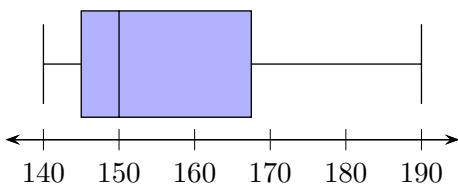
(B)   (1 mark) Class Y also had better results as $\overline{x}$ was higher.

Question 10

(a)   i.   (1 mark)

$$g(x) = 6 - 4x$$
$$g(5) = 6 - 4(5)$$
$$= 6 - 20 = -14$$

ii.   (1 mark)

$$g\left(\frac{1}{2}x\right) = 6 - 4\left(\frac{1}{2}x\right)$$
$$= 6 - 2x$$

iii.   (1 mark)

$$f : y = 6 - 4x$$
$$f^{-1} : x = 6 - 4y$$
$$x - 6 = -4y$$
$$y = f^{-1}(x)$$
$$= -\frac{1}{4}x + \frac{3}{2}$$

(b)   i.   (2 marks)

✓   [1] for shape.

✓   [1] for showing points.
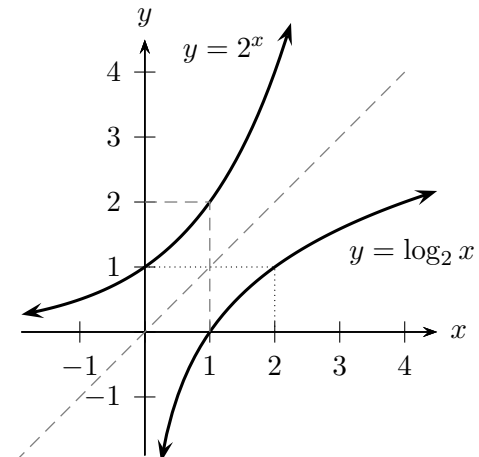
ii. (2 marks)

$$D = \{x : x \in \mathbb{R}\}$$
$$R = \{y : y > 0\}$$

iii. (1 mark) Yes – for each unique x value there is only one corresponding y value.

iv. (2 marks) See part (i).

v. (2 marks)

- ✓ [1] for shape.
- ✓ [1] for demonstrating $y = f(x) - 3$ is a shift of 3 units down, in whatever appropriate method.