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### Semester One Examination, 2017

### Question/Answer booklet

# MATHEMATICS

**SOLUTIONS**

**APPLICATIONS**

**UNIT 1**

## Section One:

## Calculator-free

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Student Number: In figures |  |  |  |  |  |  |  |  |  |  |

 In words

 Your name

## Time allowed for this section

Reading time before commencing work: five minutes

Working time: fifty minutes

## Materials required/recommended for this section

***To be provided by the supervisor***

This Question/Answer booklet

Formula sheet

***To be provided by the candidate***

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: nil

## Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

## Structure of this paper

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Section | Number of questions available | Number of questions to be answered | Workingtime (minutes) | Marks available | Percentage of examination |
| Section One:Calculator-free | 7 | 7 | 50 | 51 | 35 |
| Section Two:Calculator-assumed | 13 | 13 | 100 | 100 | 65 |
|  |  | **Total** | 100 |

## Instructions to candidates

1. The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet.

3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.

4. Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

5. Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.

6. It is recommended that you do not use pencil, except in diagrams.

7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Section One: Calculator-free 35% (51 Marks)

This section has**seven (****7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 50 minutes.

Question 1 (6 marks)

One Australian dollar can buy 50 Indian rupees.

(a) How many Indian rupees can be bought for 30 Australian dollars? (1 mark)

|  |
| --- |
| **Solution** |
| $30×50=1 500$ rupees |
| **Specific behaviours** |
| ✓ multiplies correctly |

(b) Determine how many Australian dollars are required to buy 50 000 rupees. (1 mark)

|  |
| --- |
| **Solution** |
| $$\frac{50000}{50}=\$1000$$ |
| **Specific behaviours** |
| ✓ divides correctly |

(c) A tourist going to India wants to take 50 000 rupees with them. Their bank uses the above exchange rate but also adds a commission of 1%. How much will the rupees cost the tourist altogether in Australian dollars? (2 marks)

|  |
| --- |
| **Solution** |
| $1000÷100=\$10$ commissionTotal cost is $\$1000+\$10=\$1010$ |
| **Specific behaviours** |
| ✓ calculates commission✓ calculates total cost |

(d) Over the next few months, the exchange rate is expected to change so that one Australian dollar will buy 52 rupees. Determine the percentage increase in the exchange rate from 50 to 52 rupees. (2 marks)

|  |
| --- |
| **Solution** |
| $$\frac{52-50}{50}×100=\frac{2}{50}×100=4\%$$ |
| **Specific behaviours** |
| ✓ calculates change✓ calculates percentage |

Question 2 (8 marks)

(a) Determine the value of

(i) $a^{2}+2a+3$ when $a=7$. (2 marks)

|  |
| --- |
| **Solution** |
| $$49+14+3=66$$ |
| **Specific behaviours** |
| ✓ squares and doubles✓ sums terms |

(ii) $x-xy-y$ when $x=-2$ and $y=3$. (2 marks)

|  |
| --- |
| **Solution** |
| $$-2-\left(-2×3\right)-3=-2+6-3=1$$ |
| **Specific behaviours** |
| ✓ substitutes correctly✓ evaluates |

(b) Calculate the price-to-earnings ratio for a share with a market price of $2.75 and annual earnings per share of 25 cents. (2 marks)

|  |
| --- |
| **Solution** |
| $$PE=\frac{275}{25}=4+4+3=11$$ |
| **Specific behaviours** |
| ✓ uses PE formula with correct units✓ evaluates ratio |

(c) The price-to-earnings ratio for a share is 20. If the market price of the share is $1.10, determine the annual earnings per share. (2 marks)

|  |
| --- |
| **Solution** |
| $$20=\frac{110}{E}⇒E=\frac{110}{20}=\frac{55}{10}=5.5 cents per share$$ |
| **Specific behaviours** |
| ✓ uses PE formula correctly✓ solves for EPS, stating units |

Question 3 (8 marks)

Solve the following equations, showing working where necessary.

(a) $0.2x=5$ (1 mark)

|  |
| --- |
| **Solution** |
| $$x=25$$ |
| **Specific behaviours** |
| ✓ Solves correctly |

(b) $x^{3}=-64$ (1 mark)

|  |
| --- |
| **Solution** |
| $$x=-4$$ |
| **Specific behaviours** |
| ✓ Solves correctly |

(c) $7-\frac{x-8}{2}=-4$ (2 marks)

|  |
| --- |
| **Solution** |
| $$\frac{x-8}{2}=11$$$$x=30$$ |
| **Specific behaviours** |
| ✓ subtracts 7 from both sides and cancels negative✓ multiplies by 2 and adds 8 |

(d) $\frac{x-1}{3}=\frac{x+5}{2}$ (2 marks)

|  |
| --- |
| **Solution** |
| $$2\left(x-1\right)=3(x+5)$$$$x=-17$$ |
| **Specific behaviours** |
| ✓ cross multiplies✓ expands and solves to get $x=-17$ |

(e) $\frac{2}{3}=2x+\frac{1}{2}$ (2 marks)

|  |
| --- |
| **Solution** |
| $$\frac{1}{6}=2x$$$$\frac{1}{12}=x$$ |
| **Specific behaviours** |
| ✓ subtracts $\frac{1}{2}$ from $\frac{2}{3} $to get $\frac{1}{6}$✓ divides $\frac{1}{6} $by 2 to get $\frac{1}{12}$ |

Question 4 (6 marks)

(a) An investor received a dividend of $240 on 60 shares in a mining company. Calculate the dividend per share. (1 mark)

|  |
| --- |
| **Solution** |
| $$\$240÷60=\$4 per share$$ |
| **Specific behaviours** |
| ✓ calculates dividend per share |

(b) Another company paid a dividend of 25 cents per share to an investor who held 2 000 shares in the company.

(i) Calculate the total dividend the investor was paid. (1 mark)

|  |
| --- |
| **Solution** |
| $$0.25×2000=\$500$$ |
| **Specific behaviours** |
| ✓ calculates total dividend |

(ii) The investor had to pay income tax of 30% on the total dividend. Determine how much the investor received after tax had been deducted. (2 marks)

|  |
| --- |
| **Solution** |
| $$0.3×500=\$150$$$$500-150=\$350$$ |
| **Specific behaviours** |
| ✓ calculates tax✓ calculates remainder |

(c) A shareholder has 500 shares with a market price of 40 cents per share in a technology company, and the company has announced a dividend per share of 1.5% of the share price. Determine the total dividend the investor can expect. (2 marks)

|  |
| --- |
| **Solution** |
| $$500×0.4×0.015=200×0.015=\$3$$ |
| **Specific behaviours** |
| ✓ uses correct method✓ determines correct dividend, with units |

Question 5 (7 marks)

A freight company has a display at a trade exhibition that includes various scale models of its standard shipping containers (such a container can be closely modelled by a rectangular prism). A full-size standard container is 12.0 m long, 2.4 m wide and 2.5 m high.

(a) One of the scale models was built to a one-tenth scale of a full-size container. State the length, width and height of this model, in centimetres. (3 marks)

|  |
| --- |
| **Solution** |
| $$L=\frac{12}{10}×100=120, W=\frac{2.4}{10}×100=24, H=\frac{2.5}{10}×100=25 cm$$ |
| **Specific behaviours** |
| ✓ uses scale factor✓ converts from m to cm✓ clearly states length, width, height |

(b) Another model was made to a scale of 1:100. If the area of the floor of a full-size container is 288 000 cm2, determine the area of the floor of this model. (2 marks)

|  |
| --- |
| **Solution** |
| $$A=\frac{288000}{100×100}=28.8 cm^{2}$$ |
| **Specific behaviours** |
| ✓ uses square of scale factor✓ determines area |

(c) The largest model was built to a one-half scale of a full-size container. Determine the volume of this scale model. (2 marks)

|  |
| --- |
| **Solution** |
| $$V=\frac{2.4}{2}×\frac{2.5}{2}×\frac{12}{2}=\frac{2.4}{8}×30=0.3×30=9 m^{3}$$ |
| **Specific behaviours** |
| ✓ uses cube of scale factor✓ determines volume, stating units*\* challenging calculation* |

Question 6 (6 marks)

(a) I think of a number, triple it, then subtract the result from 20. The result is 8 more than the number I first thought of. By writing an equation and solving it, determine the number.

 (2 marks)

|  |
| --- |
| **Solution** |
| $20-3x=x+8$ OR $20-3x-8=x$$$x=3$$ |
| **Specific behaviours** |
| ✓ writes correct equation✓ solves equation correctly |

(b) The length of a rectangle is 3cm more than double its width. The rectangle’s perimeter is 66cm. By first writing an equation and solving it to find the rectangle’s width, determine the area of the rectangle. (3 marks)

|  |
| --- |
| **Solution** |
| $$2x+2\left(2x+3\right)=66$$$$x=10$$Width =10, therefore length=23, so area is 230cm2 |
| **Specific behaviours** |
| ✓ writes correct equation✓ solves equation correctly✓ determines area |

(c) June is 42 years older than Tim. In ten years time their ages will be such that June will be twice as old as Tim. By writing an equation and solving it, determine how old June is now. (3 marks)

|  |
| --- |
| **Solution** |
| $$2\left(x+10\right)=x+42+10$$$$x=32$$Tim is currently 32, therefore June is currently 74. |
| **Specific behaviours** |
| ✓ writes correct equation✓ solves equation correctly✓ determines June’s current age |

Question 7 (8 marks)

(a) Write the scale 5 mm : 30 cm as a ratio in simplest form and without units. (2 marks)

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| --- |
| **Solution** |
| $$5 mm :300 mm=1 :60$$ |
| **Specific behaviours** |
| ✓ converts measurements to same unit✓ simplifies ratio |

(b) Three similar triangles are shown below, although they are not drawn to the same scale. Some of the side lengths, in centimetres, are shown.



 Determine the lengths $a, b, c$ and $d$. (4 marks)

|  |
| --- |
| **Solution** |
| Lengths of LH triangle are $\frac{12}{3}=4×$ middle triangle and $\frac{24}{12}=2×$ RH triangle.$a=4×4=16$ cm, $b=\frac{24}{4}=6$ cm, $c=\frac{12}{2}=6$ cm and $d=\frac{16}{2}=8$ cm. |
| **Specific behaviours** |
| ✓ uses ratio of lengths of LH and middle triangles✓ determines $a$ and $ b$✓ uses ratios of lengths of RH and another triangle✓ determines $c$ and $d$ |

(c) A student used a map drawn to a scale of $1:10 000$ to plan a walk. The length of the walk on the map was $5.5$ cm. State, with reasoning, whether the length of the walk was more than a kilometre. (2 marks)

|  |
| --- |
| **Solution** |
| No, walk was less than 1 km.$\frac{5.5×10000}{100}=550$ m |
| **Specific behaviours** |
| ✓ states less✓ states walk is 550 m long. |

Additional working space

Question number: \_\_\_\_\_\_\_\_\_

Additional working space

Question number: \_\_\_\_\_\_\_\_\_

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