Notes to marking:

- Correct answers will gain full marks unless working is specifically required or for an E grade. To be “working” it must be clearly laid out in logical sequence – the mere presence of numbers written down does not automatically count as working.

- Incorrect answers with full and correct working may be awarded a grade, provided the mistake was an entry error or similar, not a misunderstanding.
  
  e.g. 3% of 40 = 3 ÷ 100 × 40 = 12, rather than 1.2, is clearly entering 10 for 100 or 400 for 40 in the calculator and can be given full marks.

  However 4 × 3² = 24 arises when a student mistakes 3² for 3 × 2, which is an not a mechanical error, and cannot be given a mark.

- Almost correct answers gain no marks even if it is clear that the student has made a simple mistake (e.g. writing 12 for 3% of 40) if there is no working shown. Students should show all working to avoid this situation.

- Incorrect or inappropriate rounding is not penalised unless specifically noted.

- Full marks can be given if a question is correctly solved but using the wrong answer from a separate previous question (usually these will be indicated “allow COE”, for carry-over error)

- Algebra questions must be solved algebraically. A correct answer is insufficient if it is found via non-algebraic methods
  
  e.g. in solving 3x + 3 = 5x + 7 it is not sufficient to state that 3 × -2 + 3 = 3 and 5 × -2 + 7 = 3 and so the answer is x = -2.

- In general a multi-part “M” question with one complete step correctly answered (with working) but a single mistake may be given an “A”.

- An “E” question with working shown and only one error may given an “M”, provided it is clear that the student has sufficient understanding.

Notes to Grades:

- For each section the required number of questions for each grade level is shown. The grade boundaries shown are indications only. The standard in the actual exam may be higher or lower.

- Higher grade answers may count down, but lower grades never count up.
  
  7 “A” and 3 “M” answers has more than the 9 questions to reach the Achieved grade in Number, as the “M” can count down as “A”.

  9 “M” and 2 “E” does not get Excellence in Number.
The boxes show the required number of questions for each grade level

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QUESTION ONE

a) \( 68\% \quad (0.68) < \frac{32}{5} \quad (6.4) < 6.42 < 6.5 \quad \text{A reasons and conversions not required} \)

b) \(-5\frac{1}{2} \quad (-5.5) < -5 < -4.6 < -4 \quad \text{A reasons and conversions not required} \)

QUESTION TWO

a) \$75,000 \quad \text{A} \)

b) \( \frac{5}{17} \times 416000 \quad \$122,353 : \$293,647 \quad \text{M Don’t need $, accept any rounding} \)

QUESTION THREE

\$447,000 \quad \text{A} \)

QUESTION FOUR

\( \frac{27}{100} \times 43500 = 11,745 \quad \text{A} \)

QUESTION FIVE

\( \frac{5200}{43500} \times 435 \quad 11.95\% \quad \text{A rounding to any d.p. if working shown} \)

QUESTION SIX

a) \( \frac{4}{100} \times 43500 = 1740 \quad 43500 + 1740 = \)

\( \quad \text{or} \quad 1.04 \times 43500 \quad 45,240 \quad \text{M} \)

b) \( 43500 \div 0.97 \quad 44,845 \quad \text{E} \)

QUESTION SEVEN

\( 250000 \times 1.05^8 \quad \$369,363 \quad \text{E} \)
QUESTION EIGHT

\[ \frac{2}{9} = 0.2222 \] originally

\[ \frac{3}{11} = 0.2727 \] afterwards

an increase of \( 0.0505 \) from 0.2222, so

\[ \frac{0.0505}{0.2222} \times 100 = 22.7\% \]

E

QUESTION NINE

a) \[ \frac{12}{100} \times 12.50 = 1.5 \]

12.5 – 1.5 =

or \[ 0.88 \times 12.5 = \]

\$11 \ M

b) \[ \frac{0.5}{12.5} \times 100 \]

4% \ M

QUESTION TEN

0.74 × 34 = 25.16 trucks worth of work if used 100%

increasing the amount of work by a fifth, \( 1.2 \times 25.16 = 30.192 \)

but they can only be used at 80%, so \( 30.192 \div 0.8 = 37.74 = 38 \)

which is an increase from 34 trucks of

4 more \ E

QUESTION ELEVEN

a) In 40 hours they earn 40 × 22 = $880, so they need an extra $120

For overtime they earn \( 1.5 \times 22 = $33 \) an hour

120 ÷ 33 =

\[ 4 \text{ hours} \quad \text{E} \quad \text{allow 3.6 etc} \]

b) To earn $1000 in 40 hours, they need to earn \( 1000 \div 40 = $25 \) an hour

25 is \[ \frac{3}{22} \times 100 \]

\[ 13.6\% \quad \text{M} \quad \text{A for "13"} \]

QUESTION TWELVE

DJ = 3 × 80 = 240

1.15 × 240 = $276

Decorations are 400 × 1.08 = 432

Fixed costs are $2000 + 1500 + 276 + 432 = $4208

\[ \frac{3}{5} \times 162 = 97 \] plus \( 0.65 \times 97 = 63 \), so 160 people approximately will go

4208 ÷ 160 = 26.3. Add in cost of dinner + 30 =

\[ \$56.30 \quad \text{E} \quad \text{M if small mistake} \]

QUESTION THIRTEEN

5.8M US ÷ 0.63 = 9.2M NZD

Discount of 8% makes it \( 9.2 \times 0.92 = $8.47M \)

Over 5 years = 60 months

8.47 ÷ 60 = (rounded)

\[ \$140,000 \text{ per month} \quad \text{E} \quad \text{M if small mistake} \]
Algebra and Graphs

The boxes show the required number of questions for each grade level

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**QUESTION ONE**

a) $4e$  
   A no alternatives

b) $4h$  
   A no alternatives

c) $9x - 2xy$  
   M or $-2xy + 9x$ no other alternatives

d) $3p^2$  
   A no alternatives

e) $20x^5y$  
   M no alternatives

**QUESTION TWO**

a) $8n - 6$  
   A accept if $x$ used instead of $n$

b) $4(n + 2)$  
   M or $(2 + n) \times 4$ or $4n + 8$ etc, with brackets or expanded

**QUESTION THREE**

a) $2 \times 4 \times 5 = 40$  
   A

b) $(4 \times 4) - (-3) = 19$  
   A

**QUESTION FOUR**

The mid-way equations in red **must** be shown, somewhere, for M – or the maximum mark is A. The grey working need not be shown, although students are encouraged to show all working.

a) $x - 12 = 4$  
   $x = 16$  
   A

b) $5x + 11 = 2$  
   $n = \frac{-9}{5}$ or $-1.8$  
   A
c) \[ 21 = 3x - 15 \]
\[ +15 \quad +15 \]
\[ 36 = 3x \]
\[ +3 \quad +3 \]
x = 12 \quad \text{A} \quad \text{accept } x = \frac{36}{3} \]
d) \[ 2x + 24 = 6x + 13 \]
\[-2x \quad -13 \quad -2x \quad -13 \]
\[ 11 = 4x \]
\[ +4 \quad +4 \]
x = \frac{11}{4} \text{ or } 2.75 \quad \text{M} \quad \text{accept } x = \frac{-11}{4} \]
e) \[ 2x + 8 = 4x - 20 \]
\[-2x \quad +20 \quad -2x \quad +20 \]
\[ 28 = 2x \]
\[ +2 \quad +2 \]
x = 14 \quad \text{M} \]

**QUESTION FIVE**

No marks are to be awarded for a solution that does not start with an equation or is not solved using algebra – such as showing the answer works by \(7 + 7 + 8 = 22\).

a) \[ c + h = 22 \]
We know \(c = h + 8\) so \(c + c + 8 = 22\)
\[ 2c + 8 = 22 \]
\[-8 \quad -8 \]
\[ 2c = 14 \quad \text{7 biscuits} \quad \text{M} \quad \text{answer must be clear} \]
b) \[ 30m + 25 = 400 \]
\[-25 \quad -25 \]
\[ 30m \]
\[ +30 \quad +30 \]
\[ 375 = 12.5 \text{ km} \quad \text{M} \quad \text{answer must be clear} \]
c) \[ \frac{x + 6}{2} = \frac{x + 16}{7} \]
\[7x + 42 = 2x + 32 \]
\[-2x \quad -42 \quad -2x \quad +42 \]
\[5x = -10 \]
The numbers is \(-2\) \quad \text{E} \]

**QUESTION SIX**

a) \[ T = 0.1(85000 - 40000) = \quad \$4,500 \quad \text{A} \]
b) \[ 4800 = 0.1(E - 40000) \]
\[ 4800 = 0.1E - 4000 \]
\[ + 4000 \quad + 4000 \]
\[ 8800 = 0.1E \quad \$88,000 \quad \text{A} \quad \text{allow answer only} \]
c) \[ T = 0.1E - 4000 \]
\[ E = \frac{T + 4000}{0.1} \quad \text{E} \quad \text{or equivalent} \]
equivalents include: \(E = 10(T + 4000); \quad E = 10T + 40,000 \quad \text{and } \quad E = \frac{T}{0.1} + 40,000 \]
QUESTION SEVEN

a) $3x - 15$  
   A  no alternatives

b) $2xy + 4x$  
   A  or $2y\cdot x + 4x$  no other alternatives

c) $5x^2 + 15x$  
   A  no alternatives

d) $4x + 24 + 2x - 20$  
   $= 6x + 4$  
   M  no mark if student continues and gives $6x + 4 = 10x$

e) $x^2 + 10x + 2x + 20$  
   $= x^2 + 12x + 20$  
   M  any order

QUESTION EIGHT

a) $10(x + 2)$  
   A  no alternatives

b) $x(x + 4)$  
   A  no alternatives

c) $2x(5 + 2x)$  
   M  or $2x(2x + 5)$  no other alternatives

d) $(x + 5)(x + 3)$  
   M  or $(x + 3)(x + 5)$  no other alternatives

e) $(x + 1)(x - 13)$  
   E  or $(x - 13)(x + 1)$  no other alternatives

QUESTION NINE

a) $\frac{a + a + 4}{2} \times 5$  
   A  or equivalent

   $\frac{2a + 4}{2} \times 5$  
   $\frac{10a + 20}{2}$  
   $5a + 10$  
   M

b) $\frac{2a + 4}{2} \times 5 = 60$  
   or  $5a + 10 = 60$ etc

   $\frac{2a + 4}{2} = 12$  
   $5a = 50$

   $2a + 4 = 24$

   $2a = 20$  
   $10$  
   E  must be solved from an equation, but it need not be a simplified one
Patterns and Graphs

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**QUESTION ONE**

A graph with points marked: (-8, 2), (0, 3), (6, 4), (-5, -4).

A accept one minor error, must have brackets

**QUESTION TWO**

a) 10

A

b) 34

A no working required

c) \(D = 3L - 2\)

M or equivalent

**QUESTION THREE**

a) 4 days

A accept without units

b) 2 m³ in 4 days = 0.5 m³/day

M accept without units

c) \(y = -2x + 21\)

E accept other variables e.g. \(W = -2d + 21\)

d) two of the lines shown

A

d) all three solid lines shown

M
QUESTION FOUR

a)  **Eagle, by 3 months**  
   A accept without units

b)  i)  **Hawk, from 8th to 9th months**  
   A

   ii)  **40 m per month**  
   M accept without units

c)  by reading off the graph, after **about 4.6 months**  
   A or if no reason given
   At 30/month to get to 80, plus two months behind **4.666**  
   M
   80 = 30m – 60, and solving gives after **4.667 months**  
   E

QUESTION FIVE

a)  **y = 3x – 4**  
   M or **y = 2x + -5** etc

b)  **y = -4x + 4**  
   M

c)  **y = \frac{1}{2} x + 1**  
   E or **y = 0.5x + 1** etc

QUESTION SIX

a)  as shown  
   A

b)  as shown  
   M

c)  as shown  
   E
Measurement

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QUESTION ONE

a) **0.85** km

b) **2500** mL  
   A if a) and b) both correct

c) **12** hours

d) **108** hours  
   A if c) and d) both correct

QUESTION TWO

a) **tonnes** or **t**  
   A accept Mg or megagrams

b) **centimetres squared** or **cm²**  
   A

QUESTION THREE

a) \( \pi \times 35 = \)  
   **110 mm**  
   M need answer and units.

b) **70 + 40 + 40 =**  
   **150 mm**  
   A need answer and units.

c) **\( \frac{1}{2} \times 20 \times 70 = \)**  
   **700 mm²**  
   M need answer and units.

QUESTION FOUR

a) **2:35 p.m.**  
   M need p.m.

a) **1315**  
   A do not allow 1315 p.m.

a) **140 minutes**  
   A need units
QUESTION FIVE

a) Outer radius is half 90 minus two, so outer circle area is $\pi \times 43^2 = 5809 \text{ cm}^2$

Inner radius is half 60, so outer circle area is $\pi \times 30^2 = 2827 \text{ cm}^2$

Cross section area is therefore $5809 - 2827 = 2982 \text{ cm}^2$

Depth is 30 minus rubber on both sides = 28 cm

Volume is $2982 \times 28 = 83,496 \text{ cm}^3$

$83496 \div 500 = 167 \text{ seconds}$

E accept any rounding, with working

M for minor error

must have units

QUESTION SIX

a) $12 \times 4.8 \times 4.4 = 253.44 \text{ m}^3$

M need units

b) $\pi \times 1.9^2 \times 12.2 = 138.4 \text{ m}^3$

138,400 L E allow any rounding

QUESTION SEVEN

The semicircle’s area = $\pi \times 40^2 \div 2 = 2513 \text{ m}^2$

The bottom trapezium = $\frac{1}{2} (80 + 110) \times 28 = 2660 \text{ m}^2$

The left trapezium = $\frac{1}{2} (70 + 60) \times 40 = 2600 \text{ m}^2$

The rectangle in the middle = $22 \times 26 = 572$

A for any of these correct

M if two shapes are correct

The total area is $2513 + 2660 + 2600 - 572 \text{ m}^2$

$7201 \text{ m}^2$ E

need answer clearly stated with units
Trigonometry

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**QUESTION ONE**

a) \(0.643\)  
   A accept any rounding

a) \(41.35°\)  
   A accept any rounding

a) \(11.75\)  
   A accept any rounding

**QUESTION TWO**

\[10^2 + 24^2 = 676 \quad 26^2 = 676\]

\(a^2 + b^2 = c^2\) so it must be a right angled triangle  
A

**QUESTION THREE**

a) \(20^2 + 18^2 = 724\)  
   \(\sqrt{724} = 26.91\)  
   A accept any rounding with working

b) \(360^2 - 270^2 = 56700\)  
   \(\sqrt{\text{ans}} = 238.1\)  
   A accept any rounding with working

c) \(\sin(42) \times 15 = 10.04\)  
   A accept any rounding with working

**QUESTION FOUR**

\[\tan^{-1}(\frac{81}{55}) = 55.82°\]  
M accept any rounding with working

**QUESTION FIVE**

\[\cos^{-1}(\frac{12}{16}) = 41.41°\]  
M accept any rounding with working
QUESTION SIX

\[ x = \cos(80) \times 70 = 12.16 \]

take that off from 70 gives \( 57.85 \) **M** accept any rounding with working

QUESTION SEVEN

\[ b = b_1 + b_2 = \cos(22) \times 50 + \cos(44) \times 27 = 65.78 \] **M** accept any rounding with working

QUESTION EIGHT

\[ D^2 = 10^2 + 10^2 = \sqrt{200} = 14.14 \]

The angle \( \angle EGB \) is a right angle, as this is a cube

\[ L^2 = 10^2 + 14.14^2 = \sqrt{300} = 17.32 \]

\[ \theta = \cos^{-1}(14.14/17.32) = 35.26^\circ \] **E** accept any rounding with working

QUESTION NINE

The pentagon has mirror symmetry.

\[ x^2 = 15^2 - 12.5^2 \quad \text{d} = 8.29 \]

\[ 12.5 ( = 25 \div 2) \]

\[ L = 40 + d = 48.29 \]

\[ d^2 = 48.29^2 + 12.5^2 = 2488.3 \] **E** accept any rounding with working