



St Stephen's School Carramar

SEMESTER 1 2006

Year 10 Mathematics Development: Section A

Name: SOLUTIONS

Teacher: Σ' (Gr)²an

TIME ALLOWED FOR THIS PAPER

Reading time before commencing work: 5 minutes
Working time for paper: 2 hours
Marks available 110 marks

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

TO BE PROVIDED BY THE SUPERVISOR

Two Question Papers:	Section A – Questions 1 to 9	55 marks
	Section B – Questions 10 to 17	55 marks

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Standard Items: pens, pencils, eraser, ruler

Special Items: Drawing instruments, templates and a maximum of 2 graphics calculators satisfying the conditions set by the Curriculum Council.
Two A4 size pages of notes.

INSTRUCTIONS TO CANDIDATES

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1. [3 marks]

The sizes of the angles in a triangle are in the ratio 1 : 6 : 8.

Find the size of each angle.

$$15x = 180 \quad \checkmark$$

$$x = 12^\circ \quad \checkmark$$

Angles are $12^\circ, 72^\circ, 96^\circ \quad \checkmark$

2. ^{1 1 5}
[1, 2, 2, 2 = 5 marks]

The local Shell petrol station has unleaded petrol for \$1.37 per litre.

a) How much would it cost to fill a 60-litre tank?

$$60 \times \$1.37 = \$82.20 \quad \checkmark$$

b) How many litres of the petrol can I get for \$45?

$$\frac{45}{1.37} \approx 32.85 \text{ L} \quad \checkmark$$

c) If I get 10 km/L fuel economy, then how far could I travel on 15 litres of fuel?

$$10 \times 15 = 150 \text{ km} \quad \checkmark$$

d) If it takes me 8 h 15 min to travel 792 km, what was my average speed in km/h?

$$\frac{792}{8.25} = 96 \text{ km/h} \quad \checkmark$$

3. [2, 2 = 4 marks]

Find the percentage change for the following share prices:

a) *Aussie Pets*: \$1.20 to \$0.85

$$\frac{-0.35}{1.20} \times \frac{100}{1} = 29.16\% \text{ decrease}$$

✓ ✓

b) *Flemington Bank*: \$9.34 to \$12.22

$$\frac{2.88}{9.34} \times \frac{100}{1} \approx 30.84\% \text{ increase}$$

✓ ✓

4. [5, 3 = 8 marks]

Three friends each receive \$45 000 from a lottery win and decide to invest the amount over three years at the interest rate of 5% per annum as follows:

Billy: simple interest

Bobby: compounding annually

Buddy: compounding monthly

a) Find the amount of interest earned to the nearest cent by each person.

$$\begin{aligned} \text{Billy: } I &= PRT \\ &= 45000 \times 0.05 \times 3 \\ &= \$6750 \end{aligned}$$

✓

$$\begin{aligned} \text{Bobby: } I &= 45000(1.05)^3 - 45000 \\ &\approx \$7093.12 \end{aligned}$$

✓

$$\begin{aligned} \text{Buddy: } I &= 45000\left(1 + \frac{5}{1200}\right)^{36} - 45000 \\ &\approx \$7266.25 \end{aligned}$$

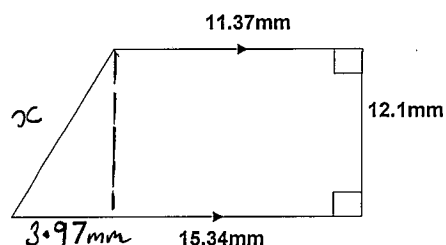
✓

b) Explain why the amounts are not the same.

Billy earns simple interest which only calculates interest on the initial principal for the entire length of the loan. ✓
Bobby's interest is compounded. Consequently he is receiving interest on the interest he has already earned. ✓
Buddy's interest is compounded more frequently hence he receives more interest than Bobby. ✓

5. [6 marks]

Find the area and perimeter of the following shape expressed correct to the nearest mm or mm^2



$$x = \sqrt{3.97^2 + 12.1^2} \quad \checkmark$$

$$\approx 12.73 \text{ mm} \quad \checkmark$$

$$\text{Perimeter} = 12.73 + 11.37 + 12.1 + 15.34$$

$$= 51.54 \text{ mm} \quad \checkmark$$

$$\approx 52 \text{ mm}$$

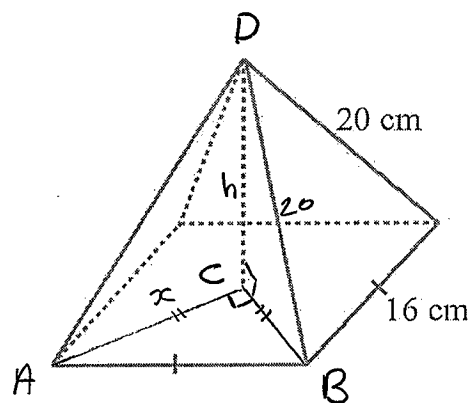
$$\text{Area} = \frac{1}{2} \times 3.97 \times 12.1 + 11.37 \times 12.1 \quad \checkmark \checkmark$$

$$\approx 161.60 \text{ mm}^2$$

$$\approx 162 \text{ mm}^2 \quad \checkmark$$

6. [6 marks]

Find the volume of this square-based pyramid.
(The perpendicular height is not 20 cm)



In $\triangle ABC$

$$2x^2 = 16^2 \quad \checkmark$$

$$x = 8\sqrt{2} \text{ cm} \quad \checkmark$$

$$\approx 11.31 \text{ cm}$$

In $\triangle CBD$

$$h = \sqrt{20^2 - 128}$$

$$= \sqrt{272} \quad \checkmark$$

$$= \sqrt{16 \times 17} \quad \checkmark$$

$$= 4\sqrt{17} \text{ cm}$$

$$\approx 16.49 \text{ cm}$$

$$V = \frac{1}{3} \text{ Area Base} \times h$$

$$= \frac{16^2}{3} \times 4\sqrt{17} \quad \checkmark$$

$$\approx 1407.35 \text{ cm}^3 \quad \checkmark$$

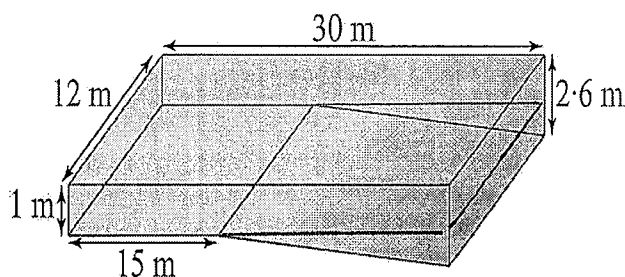
7. [3, 2, 1, 2, = 8 marks]

Find the volume of this swimming pool in:

a) cubic metres ✓ ✓

$$V = 1 \times 30 \times 12 + \frac{1}{2} \times 15 \times 1.6 \times 12$$

$$= 504 \text{ m}^3 \quad \checkmark$$



b) cubic centimetres

$$1 \text{ m}^3 = 1000000 \text{ cm}^3 \quad \checkmark$$

$$504 \text{ m}^3 = 504000000 \text{ cm}^3 \quad \checkmark$$

c) litres

$$1 \text{ m}^3 = 1000 \text{ L}$$

$$504 \text{ m}^3 = 504000 \text{ L} \quad \checkmark$$

d) If 100 kg of salt was dissolved in the pool, express the concentration of salt in grams/litre.

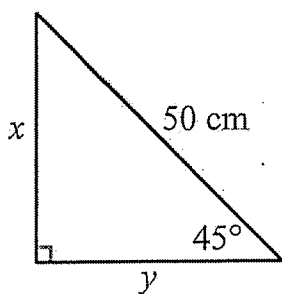
$$C = \frac{100000}{504000} \quad \checkmark$$

$$\approx 0.198 \text{ g/L} \quad \checkmark$$

8. [3, 4 = 7 marks]

Find the lengths of the unknown sides, expressed in *exact* form:

a)



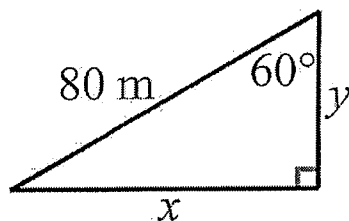
$$x = 50 \sin 45^\circ \quad \checkmark$$

$$= \frac{50}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$= 25\sqrt{2} \text{ cm} \quad \checkmark$$

$$y = 25\sqrt{2} \text{ cm} \quad \checkmark$$

b)



$$\cos 60^\circ = \frac{y}{80} \quad \checkmark$$

$$y = 40 \text{ m} \quad \checkmark$$

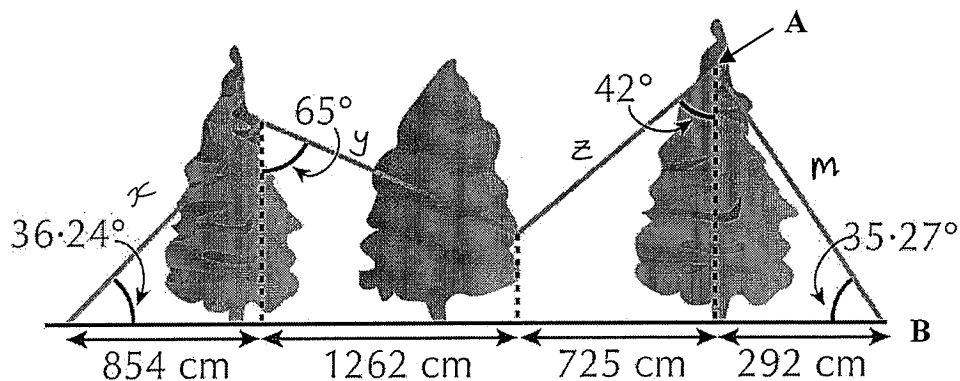
$$\sin 60^\circ = \frac{x}{80} \quad \checkmark$$

$$x = 40\sqrt{3} \text{ m} \quad \checkmark$$

- 3 8
9. [5, 4 = 0 marks]

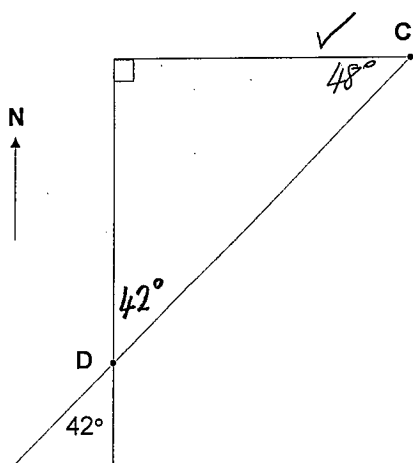
Christmas lights attached to a cable are strung through three trees.

- a) Find the length of the cable to the nearest centimetre.



$$\begin{aligned} \text{Length of cable} &= \frac{854}{\cos 36.24^\circ} + \frac{1262}{\sin 65^\circ} + \frac{725}{\sin 42^\circ} + \frac{292}{\cos 35.27^\circ} \\ &\approx 1058.83 + 1392.46 + 1083.50 + 357.65 \\ &\approx 3892 \text{ cm} \checkmark \end{aligned}$$

- b) Determine the true bearing of D from C. *and conventional bearing*



$$222^\circ \text{ T} \checkmark$$

OR

$$S 42^\circ W \checkmark$$



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3
10. [4 marks]

When four is subtracted from a certain number, and the result is multiplied by 5, the answer is equal to triple the original number. Write an equation and then solve it to find the number.

$$5(x-4) = 3x \quad \checkmark \checkmark$$

$$5x - 20 = 3x$$

$$2x = 20$$

$$x = 10 \quad \checkmark$$

11. [1, 3, 1 = 5 marks]

The relationship between the temperature expressed in degrees Celsius C and degrees Fahrenheit F is:

$$C = \frac{5}{9} (F - 32)$$

a) Find the temperature in Celsius for 240°F to the nearest degree.

$$C = \frac{5}{9} (240 - 32)$$

$$= 115.5^{\circ}\text{C}$$

$$\approx 116^{\circ} \text{ nearest degree } \checkmark$$

b) Express the relationship with F as the subject.

$$C = \frac{5}{9} (F - 32)$$

$$\frac{9C}{5} = F - 32 \quad \checkmark \checkmark$$

$$F = \frac{9}{5} C + 32 \quad \checkmark$$

c) Hence, state the temperature in degrees Fahrenheit for 150°C .

$$F = \frac{9}{5} \times 150 + 32$$

$$= 302^{\circ}\text{F} \quad \checkmark$$

12. [2, 3, 4 = 9 marks]

Simplify the following, writing your answers with positive powers:

a) $\frac{2a}{b} \times \frac{-2ax}{3b} \times \frac{ac}{b} \times \frac{a}{4b}$

$$= -\frac{a^4 c x}{3b^4} \quad \checkmark \checkmark$$

b) $\left(\frac{64y^3}{27x^{-2}}\right)^{-\frac{1}{3}}$

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

$$= \frac{3}{4 x^{\frac{2}{3}} y} \quad \checkmark \checkmark \checkmark$$

c) $\frac{16x^3}{(3y)^{-2}} \times \frac{5x^{-2}y^3z^0}{(-2y^{\frac{3}{2}})^2}$

$$= \frac{16x^3 5x^{-2} y^3}{3^{-2} y^{-2} 4 y^4} \quad \checkmark$$

$$= 180xy \quad \checkmark \checkmark \checkmark$$

13. [3, ^{7 10} marks]

Simplify each of the following:

a) $\frac{4}{x} + \frac{2}{x-1}$

$$= \frac{4(x-1) + 2x}{x(x-1)} \quad \checkmark$$

$$= \frac{6x - 4}{x^2 - x} \quad \checkmark$$

b) $\frac{x^2 - 9}{2x^2 - 4x + 2} \times \frac{6x^2 + 17x - 14}{x^2 + 4x - 21} \div \frac{2x^2 + 13x + 21}{x^2 + 6x - 7}$

$$= \frac{(x-3)(x+3)}{2(x^2 - 2x + 1)} \times \frac{(2x+7)(3x-2)}{(x+7)(x-3)} \div \frac{(2x+7)(x+3)}{(x+7)(x-1)}$$

$$= \frac{(x-3)(x+3)}{2(x-1)(x-1)} \times \frac{(2x+7)(3x-2)}{(x+7)(x-3)} \times \frac{(x+7)(x-1)}{(x+3)(2x+7)} \quad \checkmark \checkmark \checkmark$$

$$= \frac{(3x-2)}{2(x-1)} \quad \checkmark$$

14. [2, 2, = 4 marks]

Expand the brackets and simplify each of the following:

a) $(2x - 3)(4 - x)$

$$= -2x^2 + 11x - 12 \quad \checkmark \checkmark$$

b) $2x(x - 1) - 3(x + 1)$

$$= 2x^2 - 5x - 3 \quad \checkmark \checkmark$$

15. [3, 4, 1, 1 = 9 marks]

Find the equation of the line that:

a) passes through the point (1, 12) and a gradient of -2

$$\begin{aligned} y &= mx + c \\ 12 &= -2 + c \quad \checkmark \\ c &= 14 \quad \checkmark \\ \therefore y &= -2x + 14 \quad \checkmark \end{aligned}$$

b) pass through the points (-3, 5) and (2, 10)

$$\begin{aligned} m &= 1 \quad \checkmark \\ y &= mx + c \\ 10 &= 2 + c \quad \checkmark \\ c &= 8 \quad \checkmark \end{aligned} \quad y = x + 8 \quad \checkmark$$

c) is parallel to the x-axis and passes through the point (5, -2)

$$y = -2 \quad \checkmark$$

d) is perpendicular to the x-axis and passes through the point (4, 6)

$$x = 4 \quad \checkmark$$

16. [3, 3 = 6 marks]

Solve each of the following pairs of simultaneous equations:
(Demonstrate an algebraic approach)

a) $3x + 4y = -5$
 $x - y = 3 \quad \times 3$

$3x + 4y = -5$ (1)
 $3x - 3y = 9$ (2)

$-(1) - (2)$
 $7y = -14$ ✓
 $y = -2$ ✓
 $x = 1$ ✓

b) $2x - 3y = 11$
 $y = 2x - 1$

$2x - 3y = 11$ (1)
 $2x - y = 1$ ✓ (2)

$(1) - (2)$
 $-2y = 10$
 $y = -5$ ✓
 $x = -2$ ✓

17. [2, 2, 2, 3 = 9 marks]

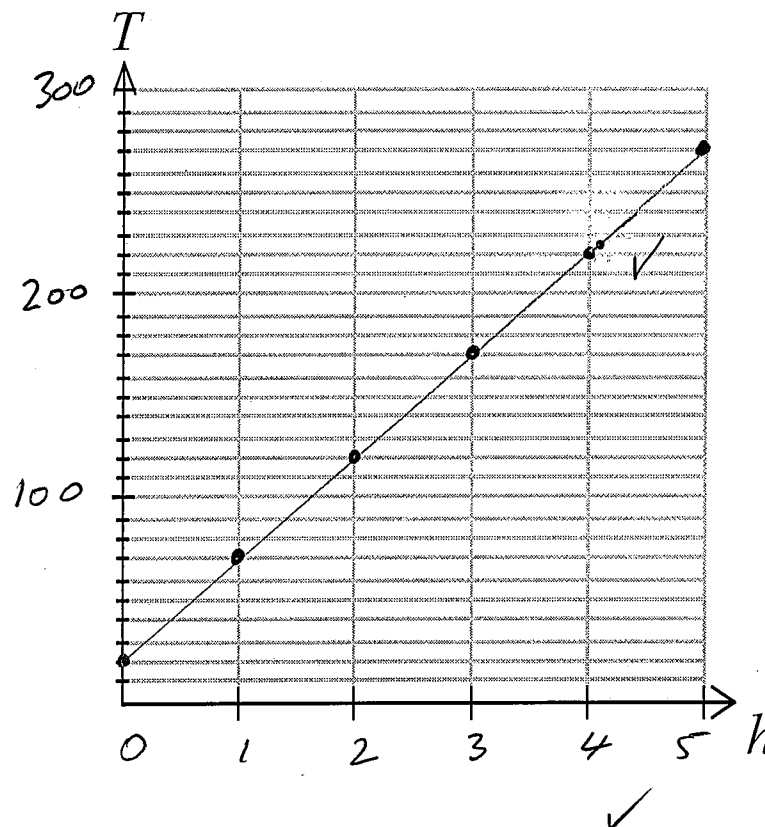
The initial temperature of an oven is 20°C . Every hour for five hours it increases by 50°C .

a) Complete a table of values to show the temperature of the oven over the time period.

h	0	1	2	3	4	5
T	20	70	120	170	220	270

- b) Plot the points onto a set of axes:

vertical axis: temperature (T) 0–300°C , horizontal axis: time (h) 0–5 hours



- c) Write the rule that connects the time (h) to the temperature of the oven (T).

$$T = 50h + 20 \quad \checkmark \checkmark$$

- d) Use the equation to find the time to the nearest second that the temperature will reach 224°C. Show this result on your graph.

$$224 = 50h + 20$$

$$50h = 204$$

$$h = 4.08 \text{ hours} \quad \checkmark$$

$$= 4 \text{ hours } 4 \text{ mins } 48 \text{ sec} \quad \checkmark$$