

Carlingford High School



Year 9 Mathematics 5.3

2018 Term 2 Examination

Name: SOLUTIONS

Circle your teacher's name: Mrs Bennett Mr Gong Mrs Hooper/Ms Gamble

Time allowed: 50 minutes

- Board approved calculators may be used.
- Show all necessary working.
- Marks may be deducted for careless or untidy work.
- Questions marked with an asterisk * are extension level questions.
- Complete the examination in blue or black pen.

Topic	Algebraic techniques	Area, surface area and volume	Financial mathematics	Total
Mark	/24	/11	/5	/40
*Extension	/13	/3	/4	/20
Total	/37	/14	/9	/60

Part 1 – Algebraic techniques (37 marks)

1A. Complete the following definitions (2 marks)

(i) $(x + 5)$ and $(x - 1)$ are called binomial expressions

(ii) $(x + 5)(x - 1)$ is called a binomial product

1B. Simplify each of the following:

(i) $5x^2 - 9x + 3x^2 + 7x = 8x^2 - 2x$ (1 mark)

(ii) $8vw \div 48v = \frac{8vw}{48v} = \frac{w}{6}$ (2 marks)

(iii) $2b \times 3a \times (-4c) = -24abc$ (2 marks)

(iv) $(-3x^4)^3 = -27x^{12}$ (2 marks)

(v) $\frac{2p}{5} - \frac{p}{15} = \frac{6p}{15} - \frac{p}{15}$ (2 marks)
 $= \frac{5p}{15}$
 $= \frac{p}{3}$

(vi) $\frac{n+2}{2} - \frac{n+1}{4} = \frac{2n+4}{4} - \frac{n+1}{4}$ (2 marks) *
 $= \frac{n+3}{4}$

(vii) $\frac{6}{r} \times \frac{5r}{9} \div \frac{15}{yh} = \frac{\overset{2}{\cancel{6}}}{\cancel{r}} \times \frac{\overset{1}{\cancel{5}}\cancel{r}}{\cancel{9}_3} \times \frac{yh}{\cancel{15}_3}$ (2 marks)
 $= \frac{2hy}{9}$

- 1C. Draw an isosceles triangle and write algebraic expressions for its side lengths so that it has a perimeter of $9x - 15$ metres. (2 marks)*

(1) - isosceles

(1) - perimeter

- 1D. Expand and simplify each of the following:

(i) $3x(6 - x) = 18x - 3x^2$ (1 mark)

(ii) $-(y - 5) = -y + 5$ (1 mark)

(iii) $(m - 4)(m + 4) = m^2 - 16$ (1 mark)

(iv) $(3n - 6)(n + 9)$ (2 marks)
 $= 3n^2 + 27n - 6n - 54$
 $= 3n^2 + 21n - 54$

(v) $4p - (p + 7)^2 + 8$ (2 marks)
 $= 4p - (p^2 + 14p + 49) + 8$
 $= 4p - p^2 - 14p - 49 + 8$
 $= -p^2 - 10p - 41$

(vi) $\left(2z - \frac{3}{4}\right)^2$ (3 marks)*
 $= (2z)^2 + 2\left(2z\right)\left(-\frac{3}{4}\right) + \left(-\frac{3}{4}\right)^2$
 $= 4z^2 - 3z + \frac{9}{16}$

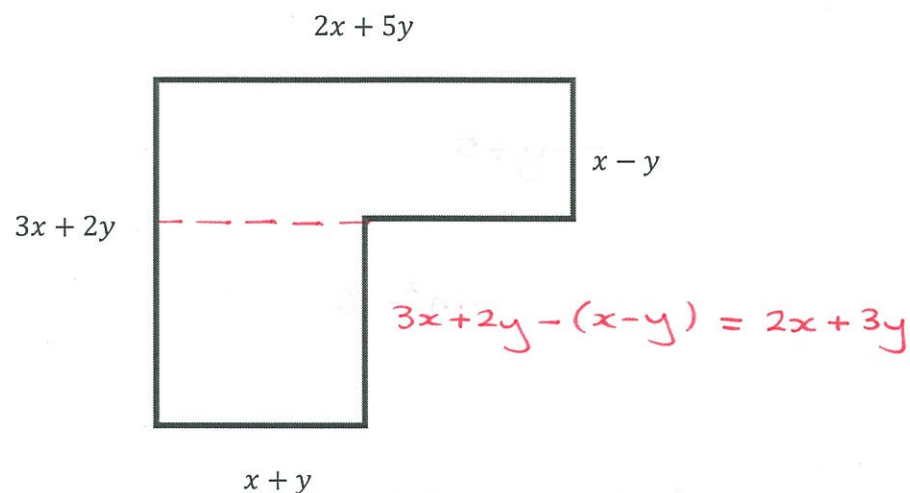
(vii) $(a - 2)^2 + (a - 2)(a + 2) - (a + 2)^2$ (3 marks)*
 $= a^2 - 4a + 4 + a^2 - 4 - (a^2 + 4a + 4)$
 $= 2a^2 - 4a - a^2 - 4a - 4$
 $= a^2 - 8a - 4$

1E. Factorise each of the following expressions:

(i) $24x + 16x^2 = 8x(3 + 2x)$ (1 mark)

(ii) $-6x^2 - 15x = -3x(2x + 5)$ (1 mark)

1F. For this composite shape, write an expression for:



(i) its perimeter (2 marks)

$$\begin{aligned}
 &= 2(2x + 5y + 3x + 2y) \quad \text{or alternate method} \\
 &= 2(5x + 7y) \\
 &= 10x + 14y \text{ units}
 \end{aligned}$$

(ii) its area (3 marks)*

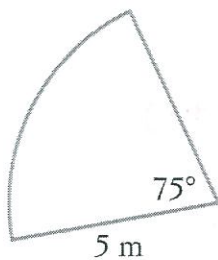
$$\begin{aligned}
 &= (2x + 5y)(x - y) + (2x + 3y)(x + y) \\
 &= 2x^2 - 2xy + 5xy - 5y^2 + 2x^2 + 2xy + 3xy + 3y^2 \\
 &= 4x^2 - 2y^2 + 8xy \text{ units}^2
 \end{aligned}$$

Part 2 – Area Surface Area and Volume (14 marks)

2A. Draw a line from each term to its correct definition. (2 marks)

Perimeter	The amount of surface covered by the shape
Area	The amount of fluid (liquid or gas) in a container
Volume	The amount of space a shape occupies
Capacity	The sum of the lengths of the sides of the shape

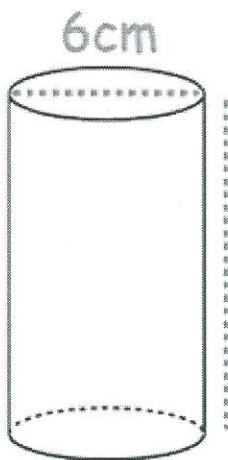
2B. Find the perimeter of this sector correct to two decimal places. (2 marks)



$$P = \frac{75}{360} \times \pi \times 10 + 5 + 5$$

$$= 16.54 \text{ m (2dp's)}$$

2C. Calculate the exterior surface area of this closed cylinder correct to 2 decimal places. (2 marks)

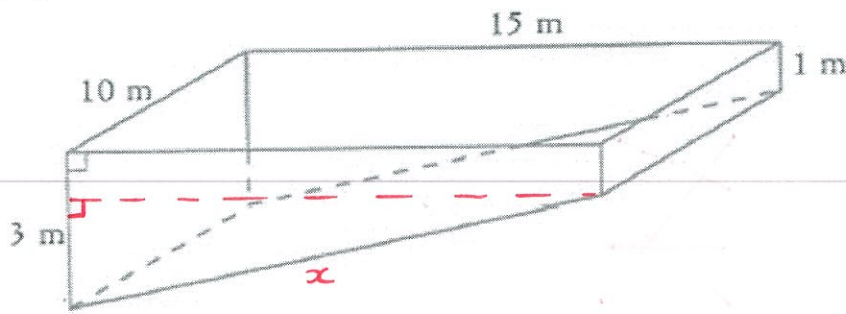


$$r = 3 \text{ cm}$$

$$SA = 2 \times \pi \times 3^2 + 2 \times \pi \times 3 \times 9$$

$$= 226.19 \text{ cm}^2$$

- 2D. This swimming pool is 15 m long and 10 m wide. The depth of the water ranges from 1 m to 3 m.



- (i) Calculate the surface area of the pool, correct to the nearest square metre. (3 marks)*

$$x^2 = 2^2 + 15^2$$

$$x = \sqrt{229}$$

$$= 15.132...$$

$$\begin{aligned} SA &= 10 \times 3 + 10 \times 1 + 10 \times 15.132... + 2 \times \frac{15}{2} (3 + 1) \\ &= 251 \text{ m}^2 \text{ (nearest m}^2\text{)} \end{aligned}$$

- (ii) If tiles cost \$8.90 per square metre, calculate the cost of tiling the pool. (1 mark)

$$\begin{aligned} 251 \times 8.90 &= \$2233.90 \\ \text{using exact SA} \quad &= \$2236.81 \end{aligned} \quad \left. \vphantom{\begin{aligned} 251 \times 8.90 &= \$2233.90 \\ \text{using exact SA} \quad &= \$2236.81 \end{aligned}} \right\} \text{ accept both}$$

- 2E. A cylindrical rain water tank has a radius of 2.8 m and a height of 2.4 m.

- (i) Calculate, the volume of the tank, correct to three decimal places. (1 mark)

$$\begin{aligned} V &= \pi \times 2.8^2 \times 2.4 \\ &= 59.112 \text{ m}^3 \end{aligned}$$

- (ii) Calculate, correct to the nearest litre, the capacity of the tank. (1 mark)

$$\begin{aligned} &= 59.112 \times 1000 \\ &= 59\,112 \text{ L} \end{aligned}$$

- (iii) If the flow rate of a hose is 24 litres per minute, how long will it take to fill the tank? Answer correct to the nearest hour. (2 marks)

$$\begin{aligned} 59\,112 \div 24 &= 2463 \text{ minutes} \\ 2463 \div 60 &= 41 \text{ h (nearest hour)} \end{aligned}$$

Part 3 – Financial mathematics (9 marks)

3A. Explain the difference between simple and compound interest. (2 marks)

Simple – interest calculated on original principal only
Compound – interest calculated on principal and any accumulated interest

3B. Wendy invests \$5 000 at 7% p.a. with interest compounding yearly for 3 years.

(i) Calculate the total value of her investment after 3 years (1 mark)

$$A = 5000(1 + 0.07)^3$$
$$= \$6125.22$$

(ii) Calculate the total amount of compound interest earned (1 mark)

$$I = 6125.22 - 5000$$
$$= \$1125.22$$

3C. \$7500 is invested for 3 years with interest compounded every six months. If at the end of the 3 years the investment is worth \$9767, what is the applied interest rate? (2 marks)*

$$9767 = 7500 \left(1 + \frac{R}{2}\right)^6$$
$$\left(1 + \frac{R}{2}\right)^6 = \frac{9767}{7500} \quad \text{accept } 0.09 \text{ (2)}$$
$$1 + \frac{R}{2} = \sqrt[6]{\frac{9767}{7500}}$$
$$R = 2 \left[\sqrt[6]{\frac{9767}{7500}} - 1 \right] \times 100$$
$$= 9\%$$

3D. A photocopying machine originally costing \$7 000 depreciates at 20% p.a.

(i) What is the value of the photocopier after 3 years? (1 mark)

$$A_3 = 7000(1 - 0.2)^3$$
$$= \$3584$$

(ii) By how much will it have depreciated during the third year? (2 marks)*

$$A_2 = 7000(1 - 0.2)^2$$
$$= \$4480$$
$$4480 - 3584 = \$896 \text{ during third year}$$

$$7000 - 3584 \text{ (1)}$$