



St. Catherine's School
Mathematics
Year 10A/B/C
Yearly Examination
October 2008

Time allowed: 90 minutes + 5 minutes reading time

INSTRUCTIONS

- There are 4 parts in this paper.
- Part A should be answered on the separate multiple choice answer sheet
- Parts B, C and D should each be answered in a **separate** writing booklet
- **Do not copy** each question into your booklet
- Clearly **label** each question being answered
- Marks for each part of a question are indicated.
- All questions should be attempted.
- All necessary working should be shown
- Approved scientific calculators and drawing templates may be used

PART A (20 marks)

The answers should be marked on the separate multiple choice answer sheet

1. $(3\sqrt{2})^2$ is equal to

A. $\sqrt{18}$	B. $\sqrt{6}$	C. 18	D. 36
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2. Simplify $4\sqrt{3} + 2\sqrt{27}$

A. $6\sqrt{30}$	B. $7\sqrt{3}$	C. $6\sqrt{3}$	D. $10\sqrt{3}$
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3. The factorised form of $x^2 - x - 12$ is:

A. $(x+4)(x-3)$	B. $(x-1)(x+12)$	C. $(x-4)(x+3)$	D. $x(x-1)-12$
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4. The solution to $2x^2 - 8 = 0$ is:

A. $x=2$	B. $x = \pm\sqrt{8}$	C. $x = \pm 2$	D. $x = 4$
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5. $x^{3/2}$ is equal to

A. $\frac{1}{x^2}$	B. $\frac{x}{2}$	C. \sqrt{x}	D. $\frac{1}{2x}$
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6. $\frac{x+3}{x^2-9}$ is equal to

A. $x-3$	B. $\frac{2}{x-3}$	C. $\frac{-1}{x-3}$	D. $\frac{1}{x-3}$
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7. $(x-y)^2$ is equal to

A. $x^2 - y^2$	B. $x^2 - 2xy + y^2$	C. $x^2 - xy + y^2$	D. $x^2 - 2xy - y^2$
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8. 0.0604 is equal to

- A. 6.04×10^{-2} B. 6.04×10^2 C. $(0.0604)^2$ D. 0.0604×10^2

9. Three times the square of half the value of x is

- A. $\frac{3x^2}{2}$ B. $\left(\frac{3x}{2}\right)^2$ C. $\left(\frac{x}{2}\right)^3$ D. $\frac{3x^2}{4}$

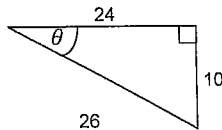
10. If \$400 is increased by 20% and the result is then decreased by 10%, the final amount is

- A. \$410 B. \$432 C. \$528 D. \$440

11. An amount of \$800 is invested at 11% compounded annually. What is the value of the investment after 3 years?

- A. \$1 094.10 B. \$264 C. \$294.10 D. \$26 400

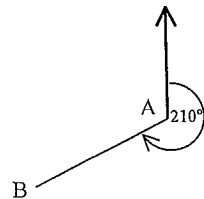
12. In this diagram $\tan \theta$ is equal to:



- A. $\frac{5}{12}$ B. $\frac{12}{5}$ C. $\frac{5}{13}$ D. $\frac{12}{13}$

13. The bearing of A from B is:

- A. 210°
 B. 030°
 C. 150°
 D. S 60° W



14. The distance between the points (-2,3) and (4,-1) is closest to:

- A. 52 units B. 13 units C. 7.2 units D. 3.6 units

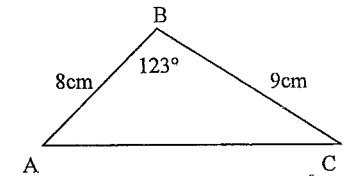
15. The gradient of the line perpendicular to $3x + y - 4 = 0$ is:

- A. 4 B. -3 C. 3 D. $\frac{1}{3}$

$y = -3x + 4$ $y = -3x -$

16. The area of the triangle ABC is:

- A. 30.2 cm^2 B. 60.4 cm^2
 C. 19.6 cm^2 D. 39.2 cm^2



17. A bag contains 4 red, 5 blue and 3 yellow discs. A disc is chosen at random. The probability of selecting a disc which is not red is:

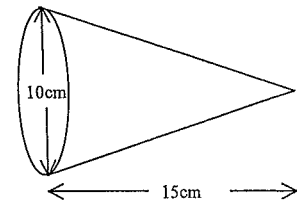
- A. $\frac{3}{4}$ B. $\frac{1}{4}$ C. $\frac{5}{12}$ D. $\frac{2}{3}$

18. An integer is selected from the integers 3 to 12 inclusive. What is the probability that the number chosen will be divisible by 2 and 3?

- A. $\frac{1}{5}$ B. $\frac{3}{10}$ C. $\frac{2}{12}$ D. $\frac{1}{10}$

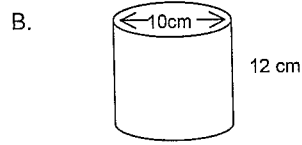
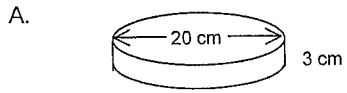
19. The volume of the solid to the nearest cm^3 is:

- A. 393 cm^3 B. 1178 cm^3
 C. 1571 cm^3 D. 4712 cm^3



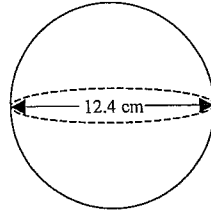
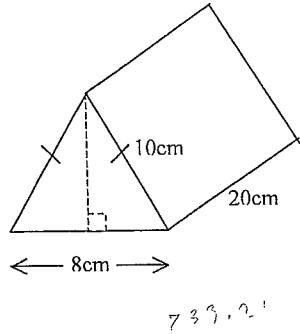
$r = 4$ $\frac{2}{10}$ 4 12 6 12 $\frac{2}{10}$

20. Which of the following containers has a capacity closest to 1 litre?



C. 942.47779

D. 942.477



Use: $V = \frac{4}{3}\pi r^3$

998

End of Part A

$4^2 + 4^2 = 10^2$

PART B (29 marks) Answer this section in a new booklet

1 (a) Simplify $\sqrt{63} \times \sqrt{28}$ ✓ /2

(b) Expand and simplify $(2\sqrt{3} - \sqrt{2})^2$ ✓ /2

(c) Rationalise the denominator of $\frac{5 + \sqrt{3}}{2\sqrt{6}}$ ✓ /2

(d) Write in index form $\sqrt[3]{a^9}$ ✓ x^{-1} ✓ $-x+1=12$ /1

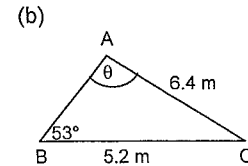
2. (a) Solve (i) $1 - 3x \geq 52$ (ii) $\frac{2x-3}{3} - \frac{x+1}{6} = \frac{2}{7}$ (iii) $(x-2)^2 = 9$ /6

(b) Use the quadratic formula to solve $3x^2 + 7x - 1 = 0$. Leave your answer in simplest surd form. /3

(c) Solve $y = x + 3$ and $5x - y = 1$ simultaneously. /3

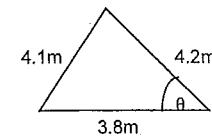
(d) Solve the following simultaneous equations $3x + 2y = 7$ $x + y = 2$ /3

3. (a) Evaluate correct to 1 decimal place $\frac{\sin 20^\circ + \sin 40^\circ}{\sqrt{0.3} + 0.6}$ /1



Find θ correct to the nearest degree.

(c) Find the value of θ , correct to the nearest minute.

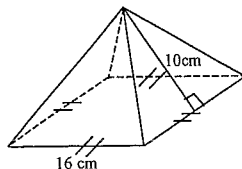


End of Part B

PART C (24 marks) Answer this section in a new booklet

1. (a) What interest rate is needed for \$7000 to yield a simple interest of \$1900 when invested for 3 years? /2
- (b) Find the amount to which a deposit of \$5500 grows in 4 years when it earns interest at 4.8% p.a. compounded monthly. /2

2. (a) A pyramid has a square base with sides of 16 cm. The distance from the top of the pyramid to the middle of each base edge is 10 cm.



Calculate

(i) the total surface area of the pyramid /2

(ii) the volume of the pyramid /3

- (b) Find the radius of a sphere that has a surface area of 800 cm^2 . Give your answer to 3 significant figures. /2

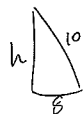
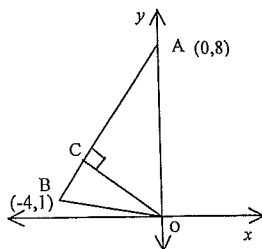
$4\pi r^2$

3. The co-ordinates of A and B are (0,8) and (-4,1) respectively. OC is perpendicular to AB.

(a) Show that the gradient of AB is $\frac{7}{4}$ /1

(b) Show that the equation of AB is $7x - 4y + 32 = 0$ /2

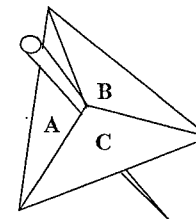
(c) What is the equation of OC? /2



PART C continued

4. (a) In a bag there are 9 discs numbered from 2 to 10. One disc is chosen at random. What is the probability that the number on the disc is:
 (i) a perfect square? /2
 (ii) not a factor of 6 or 8? /2

- (b) A spinner with symbols A, B and C is spun twice.



(i) Draw a tree diagram to show the sample space /2

(ii) What is the probability of spinning only one B? /2

(iii) What is the probability of spinning no C's? /2

End of Part C

PART A

1. $(3\sqrt{2})^2 = 9 \times 2 = 18$ (C)

2. $4\sqrt{3} + 2\sqrt{27} = 4\sqrt{3} + 2 \times \sqrt{9 \times 3} = 4\sqrt{3} + 2 \times 3\sqrt{3} = 4\sqrt{3} + 6\sqrt{3} = 10\sqrt{3}$ (D)

3. $x^2 - x - 12 = (x-4)(x+3)$ (C)

4. $2x^2 - 8 = 0$
 $2(x^2 - 4) = 0$
 $2(x-2)(x+2) = 0$
 $x-2 = 0$ OR $x+2 = 0$
 $x = 2, -2$ (C)

5. $x^{\frac{1}{2}} = \sqrt{x}$ (C)

6. $\frac{x+3}{x^2-9} = \frac{x+3}{(x+3)(x-3)} = \frac{1}{x-3}$ (D)

7. $(x-y)^2 = x^2 - 2xy + y^2$ (B)

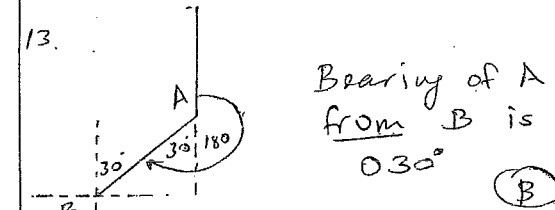
8. $0.0604 = 6.04 \times 10^{-2}$ (A)

9. $3 \times \left(\frac{x}{2}\right)^2 = \frac{3x^2}{4}$ (D)

10. $400 \times 1.2 = 480$
 $480 \times 0.9 = 432$ (B)

11. $A = 800(1+0.11)^3$
 $A = \$1094.10$ (A)

12. $\tan \theta = \frac{10}{24} = \frac{5}{12}$ (A)



14. $d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2} = \sqrt{(4-2)^2 + (-1-3)^2} = \sqrt{6^2 + 4^2} = \sqrt{52} = 7.2$ (C)

15. $3x + y - 4 = 0$
 $y = -3x + 4$
 $m = -3$
 $m_1 = \frac{1}{3}$ (D)

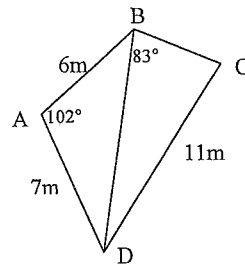
16. Area = $\frac{1}{2} ab \sin c = \frac{1}{2} \times 8 \times 9 \times \sin 110 = 30.2 \text{ cm}^2$ (A)

PART D (12 marks) Answer this section in a new booklet

(a) Use the method of completing the square to solve $x^2 + 6x = 5$. Leave your answer as an exact value.

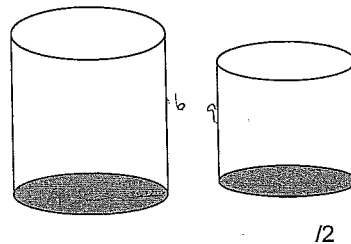
(b) If θ is either an acute or an obtuse angle, find the two possible values of θ (correct to the nearest degree) if $\sin \theta = 0.6143$

(c) Find the value of $\angle BCD$ in degrees and minutes



(d) Annie purchased a new car. Three years later she sold the car for \$23 000. If the car had depreciated by 11.2% p.a., for how much did Annie originally buy the car?

(e) The shaded areas of these similar cylinders are in the ratio 16:9. If the volume of the larger cylinder is 128 cm^3 , find the volume of the smaller cylinder.



END OF EXAM

$$17. P(\text{not red}) = \frac{5+3}{4+5+3}$$

$$= \frac{8}{12}$$

$$= \frac{2}{3} \text{ (D)}$$

18. 2: 4, 6, 8, 10, 12
3: 3, 6, 9, 12

$$P(\text{divisible 2 and 3}) = \frac{2}{10}$$

$$= \frac{1}{5} \text{ (A)}$$

$$19. V = \frac{1}{3} \pi r^2 h$$

$$= \frac{1}{3} \times \pi \times 5^2 \times 15$$

$$= 392.7$$

$$= 393 \text{ cm}^3$$

20. (A) $V = \pi \times 10^2 \times 3$

$$= 942.5 \text{ cm}^3$$

$$= 0.942 \text{ L}$$

(B) $V = \pi \times 5^2 \times 12$

$$= 942.5 \text{ cm}^3$$

$$= 0.942 \text{ L}$$

(C) $V = \frac{1}{2} \times 8 \times 6 \times 20$

$$= 480 \text{ cm}^3$$

$$= 0.48 \text{ L}$$

(D) $V = \frac{4}{3} \times \pi \times 6.2^3$

$$= 998.3 \text{ cm}^3$$

$$= 0.998 \text{ L}$$

D is closest to 1 litre (D)

(2)

PART B (29 MARKS)

1(a) $\sqrt{63} \times \sqrt{28} = \sqrt{9 \times 7} \times \sqrt{4 \times 7}$ 2

$$= 3\sqrt{7} \times 2\sqrt{7} \text{ --- (1)}$$

$$= 6 \times 7$$

$$= 42 \text{ --- (1)}$$

(b) $(2\sqrt{3} - \sqrt{2})^2 = (2\sqrt{3})^2 - 2 \times 2\sqrt{3} \times \sqrt{2} + (\sqrt{2})^2$ 2

$$= 4 \times 3 - 4\sqrt{6} + 2$$

$$= 14 - 4\sqrt{6} \text{ --- (1)}$$

(c) $\frac{5+\sqrt{3}}{2\sqrt{6}} = \frac{5+\sqrt{3}}{2\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} \text{ --- (1)}$ 2

$$= \frac{\sqrt{6}(5+\sqrt{3})}{2 \times 6}$$

$$= \frac{5\sqrt{6} + \sqrt{18}}{12} \text{ --- (1) better } \frac{5\sqrt{6} + 3\sqrt{2}}{12}$$

(d) $\sqrt[3]{a^9} = (a^9)^{\frac{1}{3}}$ 1

$$= a^{9 \times \frac{1}{3}}$$

$$= a^3 \text{ --- (1) right or wrong}$$

2(a) (i) $1 - 3x \geq 52$

$$-3x \geq 51$$

$$x \leq \frac{51}{-3} \text{ (1) for } -17$$

$$x \leq -17 \text{ (1) for } \leq$$
 2

(ii) $\frac{2x-3}{3} - \frac{x+1}{6} = 2$

$$\frac{2(2x-3)}{6} - \frac{x+1}{6} = 2$$

$$\frac{4x-6-x-1}{6} = 2 \text{ --- (1)}$$

$$\frac{3x-7}{6} = 2 \quad 3x = 19$$

$$3x - 7 = 12 \quad x = \frac{19}{3} \text{ --- (1) 2}$$

PART B

(a) (iii) $(x-2)^2 = 9$

$x-2 = \pm\sqrt{9}$

$x-2 = \pm 3$

$x = \pm 3 + 2$

$x = 3+2$ or $-3+2$

$x = 5, -1$ with working. ✓

2

(b) $3x^2 + 7x - 1 = 0$ a=3 b=7 c=-1

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-7 \pm \sqrt{7^2 - 4 \times 3 \times -1}}{2 \times 3}$

① substitution into correct formula.

$x = \frac{-7 \pm \sqrt{61}}{6}$

① answer.

3

(c) $y = x + 3$ (1)

$5x - y = 1$ (2)

Sub (1) into (2)

$5x - (x + 3) = 1$

$5x - x - 3 = 1$

$4x - 3 = 1$

$4x = 4$

$x = 1$

Sub $x=1$ into (1)

$y = 1 + 3$

$\therefore y = 4$

so $x=1, y=4$

① ①

① working

3

(d) $3x + 2y = 7$ (1)

$x + y = 2$ (2)

(2) x3 $3x + 3y = 6$ (3)

$3x + 2y = 7$ (1)

① working

(3)-(1) $y = -1$

Sub $y=-1$ into (2)

$x + -1 = 2$

$x = 3$

$x=3, y=-1$

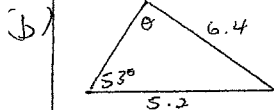
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PART B

3(a) $\frac{\sin 20^\circ + \sin 40^\circ}{\sqrt{0.3} + 0.6} = 0.85805$

$= 0.9$ (1 d.p.)

① no half marks



$\frac{\sin \theta}{5.2} = \frac{\sin 53^\circ}{6.4}$

$\sin \theta = \frac{\sin 53^\circ \times 5.2}{6.4}$

$\theta = 40^\circ 27'$

$\therefore \theta = 40^\circ$ nearest degree

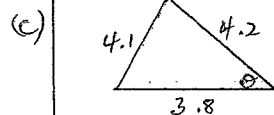
①

①

3

①

1/2 if incorrect rounding once



$\cos \theta = \frac{3.8^2 + 4.2^2 - 4.1^2}{2 \times 3.8 \times 4.2}$

$= \frac{15.27}{31.92}$

$\cos \theta = 0.47838 \dots$

$\theta = 61^\circ 25'$ nearest minute

①

①

3

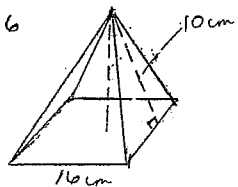
①

PART C (24 MARKS)

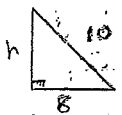
(a) $SI = Prt$ $P = 7000$
 $1900 = 7000 \times r \times 3$ $SI = 1900$
 $1900 = 21000r$ $t = 3$
 $\frac{1900}{21000} = r$ $r = ?$
 $0.09 = r$
 $\therefore r = 9\%$

(b) $A = P(1+r)^n$ $A = ?$
 $A = 5500(1+0.004)^{48}$ $P = 5500$
 $A = \$6661.64$ $r = \frac{4.8\%}{12} = 0.004$
 $n = 4 \times 12 = 48$

(3a) (i) $S.A = 4 \times \text{sides} + \text{base}$
 $= 4 \times (\frac{1}{2} \times 16 \times 10) + 16 \times 16$
 $= 320 + 256$
 $= 576 \text{ cm}^2$



(ii) perp height
 $10^2 = h^2 + 8^2$
 $100 = h^2 + 64$
 $36 = h^2$
 $h = 6$



$V = \frac{1}{3} \times A \times h$
 $= \frac{1}{3} \times (16 \times 16) \times 6$
 $= 512 \text{ cm}^3$

(b) $SA = 4\pi r^2$
 $800 = 4 \times \pi \times r^2$
 $\frac{800}{4\pi} = r^2$
 $r = \sqrt{\frac{800}{4\pi}}$
 $r = 7.98$ 3 s.f.

1 mark for correct substitution

1 mark for 1st line of solution
 If students obtained correct answer and then proceeded to find Interest no penalty

$\frac{1}{2}$ mark for

$V = \frac{1}{3} A h$
 2 marks for
 $\frac{1}{3} \times (16 \times 16) \times 10$
 $= \frac{2560}{3}$

1 mark correct substitution

PART C

3(a) $m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$
 $= \frac{8 - 1}{0 - -4}$
 $= \frac{7}{4}$

(b) $y - y_1 = m(x - x_1)$ use (0, 8)
 $y - 8 = \frac{7}{4}(x - 0)$

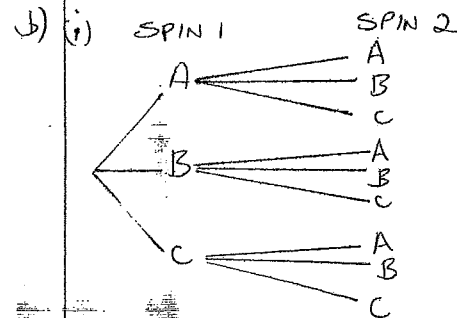
$4(y - 8) = 7x$
 $4y - 32 = 7x$
 $\therefore 7x - 4y + 32 = 0$

(c) $m_{oc} = -\frac{4}{7}$

$y - y_1 = m(x - x_1)$ use (0, 0)

$y - 0 = -\frac{4}{7}(x - 0)$
 $7y = -4x$
 $4x + 7y = 0$ is equation of oc

7(a) (i) $\frac{2}{9}$ (ii) $\frac{4}{9}$



- AA
- AB
- AC
- BA
- BB
- BC
- CA
- CB
- CC

(ii) $\frac{4}{9}$

(iii) $\frac{4}{9}$

1 mark for showing $m_{oc} = -\frac{4}{7}$

PART D (12 MARKS)

1) $x^2 + 6x = 5$

$x^2 + 6x + (\frac{6}{2})^2 = 5 + (\frac{6}{2})^2$

$(x + 3)^2 = 5 + 3^2$

$(x + 3)^2 = 14$

$x + 3 = \pm \sqrt{14}$

$x = \pm \sqrt{14} - 3$

3

2) $\sin \theta = 0.6143$

$\theta = 37^\circ 54'$

Since θ is acute or obtuse

$\theta = 37^\circ 54'$ OR $180^\circ - 37^\circ 54'$

$= 38^\circ$ OR 142° nearest degree

2

3) In $\triangle ABD$ using cosine rule to find BD

$BD^2 = 6^2 + 7^2 - 2 \times 6 \times 7 \times \cos 102^\circ$

$BD^2 = 102.4645$

$\therefore BD = 10.12$ (2 d.p.)

In $\triangle BCD$ using sine rule to find $\angle BCD$

$\frac{\sin \angle BCD}{BD} = \frac{\sin 83^\circ}{11}$

$\frac{\sin \angle BCD}{10.12} = \frac{\sin 83^\circ}{11}$

$\sin \angle BCD = \frac{\sin 83^\circ}{11} \times 10.12$

$= 0.9131$

$\therefore \angle BCD = 65^\circ 57'$

3

PART D

1) $A = P(1 - r)^n$

$A = 23000$

$P = ?$

$23000 = P(1 - 0.112)^3$

$r = 11.2\% = 0.112$

$23000 = P(0.888)^3$

$n = 3$

$\frac{23000}{(0.888)^3} = P$

$P = \$32846.49$

She bought the car for \$32846 (nearest dollar)

2

$\frac{\text{Area 1}}{\text{Area 2}} = \frac{16}{9}$

$\therefore \frac{\text{length 1}}{\text{length 2}} = \frac{4}{3}$

$\frac{\text{Volume 1}}{\text{Volume 2}} = \left(\frac{4}{3}\right)^3$

$\frac{128}{\text{Volume 2}} = \frac{64}{27}$

$\frac{\text{Volume 2}}{128} = \frac{27}{64}$

$\text{Volume 2} = \frac{27}{64} \times 128$
 $= 54 \text{ cm}^3$

2

1 for dup. \$23000

1 for using ratio 16:9 or 4:3 instead of 4³:3³