Student Name SOLUTIONS

Eastern Goldfields College
Mathematics Applications U1 2019

Test 1 – Calculator Free

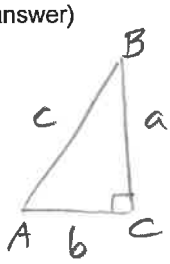
Time allowed: 15 minutes Total Marks: 14 marks

No calculator or notes permitted for this section.

Answer all of the following questions. Show all working to obtain full marks.

Question 1 [2 marks]

Which of the following statements are true for triangle ABC right-angled at C. (Circle your answer)



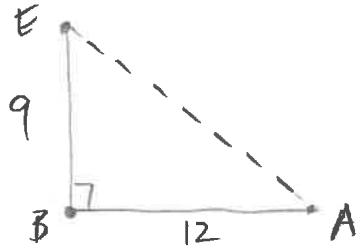
i) $a^2 = b^2 + c^2$ ii) $a^2 = b^2 - c^2$ iii) $b^2 = a^2 - c^2$

(iv) $b^2 + a^2 = c^2$ ✓ (v) $c^2 - a^2 = b^2$ ✓ vi) $a^2 + c^2 = b^2$

-1 for each extra.

Question 2 [2 marks]

Two hikers, Amy & Erin, set off from base camp. Amy walks 12 km due east and Erin walks 9 km due north. Determine the shortest distance between Amy and Erin.

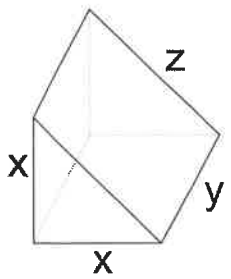


$EA^2 = 9^2 + 12^2$ ✓ must of 3,4,5

$EA = 15$ ✓

Question 3 [2 marks]

A triangular prism has dimensions x, y and z cm, as shown. Write a simplified algebraic expression for the surface area of this prism.



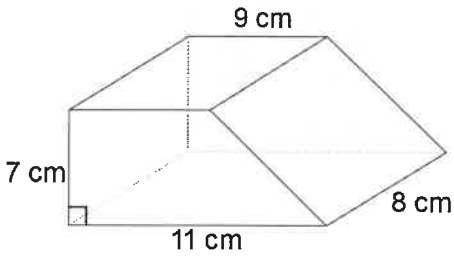
$xy + xy + zy + \frac{x^2}{2} \times 2$ ✓ any version

$= 2xy + zy + x^2$

✓ simplified

Question 4 [8 marks : 2, 2, 2, 2]

a) Calculate the volume of this quadrilateral.

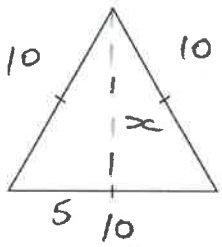


$V = \frac{9+11}{2} \times 7 \times 8$ ✓

$= 560\ cm^3$ ✓

Area of 70 ✓

b) An equilateral triangle has sides of length 10cm. What is the perpendicular height of this triangle? (nearest cm)

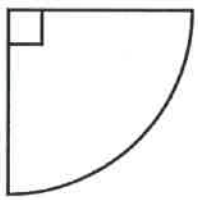


$5^2 + x^2 = 10^2$ ✓

$x^2 = 75$

$x \sim 9\ cm$ ✓

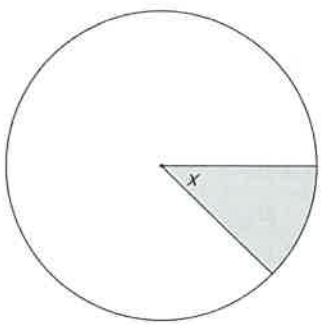
c) Calculate the exact perimeter of a quadrant of a circle with radius 12 cm.
Leave your answer in terms of π.



$P = 24 + \frac{\pi \times 24}{4}$ ✓

$= 24 + 6\pi$ ✓✓

d) A circular spinner has an area of 630 cm^2. The area of the shaded section is 70 cm^2. What is the size of the angle marked x?



$\pi \times r^2 \times \frac{x}{360} = 70$ ✓

$630 \times \frac{x}{360} = 70$

$\frac{7x}{4} = 70$

$x = 40°$ ✓

OR $\frac{630}{70} = 9$ ∴ $\frac{1}{9}$ of $360 = 40°$.

End of Calculator Free Section

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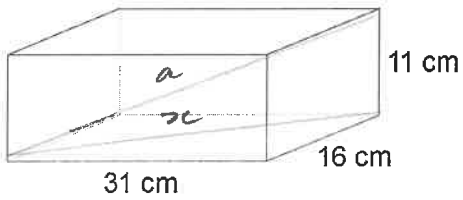
Test 2 – Calculator Assumed

Notes and calculator permitted

Time allowed: 35 minutes Total Marks: ~~34~~ 35 marks

Question 5 [4 marks: 2, 2]

A rectangular shoe box has dimensions 31 cm, 16 cm and 11 cm.



a) Calculate the length of the diagonal across the base, to the nearest mm.

$x^2 = 31^2 + 16^2$ ✓

$x^2 = 1217$

$x = 34.8855$

$\therefore$ 34.9 cm or 349 mm ✓

b) Calculate the length of the longest diagonal, to the nearest mm.

$a^2 = 11^2 + 1217$ ✓

$a^2 = 1338$

$a = 36.57868$

$\therefore$ 36.6 cm or 366 mm ✓

Question 6 [6 marks]

Marco wishes to invest $1,200 for 8 years. The following investment opportunities are available:

1. Compound interest at 8.5% p.a. compounding annually.
2. Compound interest at 8.25% p.a. compounding monthly.

Which investment plan should he choose to maximize the interest earned? Show full working to justify your answer.

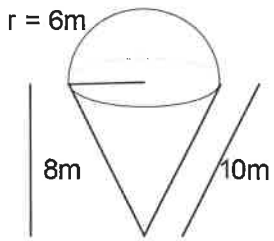
1. $1200 \times 1.085^{8} = \$2304.73$ ✓

2. $1200 \times \left(1 + \frac{0.0825}{12}\right)^{96} = \$2316.51$ ✓

Plan 2 is better ✓

Question 7 [4 marks]

Calculate the surface area of the following cone with a hemispherical lid.
The cone has a radius of 6m, vertical height of 8m and a slant height of 10m.
Give answer to nearest square metre.



$SA = 2\pi \times 6^2 + \pi \times 6 \times 10$ ✓ ✓ (226.19, 188.5)

$= 414.7\ m^2$ ✓

$\therefore 415\ m^2$ ✓

$\frac{4\pi \times 6^2}{2}$

Question 8 [4 marks]

A solid cube of stainless steel is to be melted down and made into spherical ball bearings of radius 6 mm. The cube has 50 cm edges.

How many ball bearings can be made, assuming that there will be 5% wastage in the manufacturing process? *Show all your working.*

$V_{CUBE} = 50^3$

$= 125000\ cm^3$ ✓

$V_{BALL} = \frac{4}{3}\pi (0.6)^3$

$= 0.904779\ cm^3$ ✓

$125000 \div 0.904779 = 138155.3$ ✓

$0.95 \times 138155.3 = 131247$ ✓

(5% waste)

Question 9 [10 marks: 2, 3, 2, 2]

A cylindrical concrete pipe of length 2400 mm has an external diameter of 300 mm.
The concrete is 40mm thick.

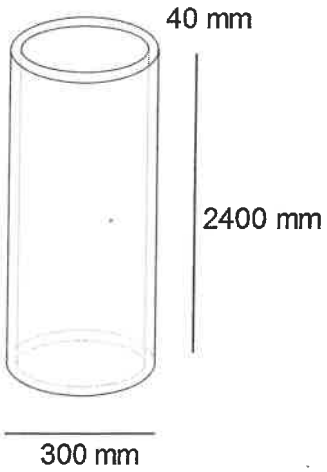
Calculate, showing all your working:

a) The surface area of the outer curved wall. *Give answer to nearest cm².*

$SA = 2\pi \times 15 \times 240$
$= 22619.467$

$\therefore 22619\ cm^2$

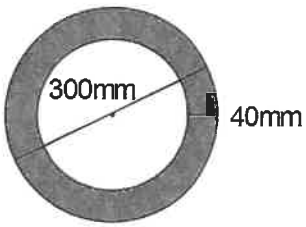
conversion ✓



b) The area of the shaded top annulus ring of the pipe.
Give answer to nearest cm².

$A = \pi \times 15^2 - \pi \times 11^2$
$= 326.7\ cm^2$

$\therefore 327\ cm^2$



c) The volume of concrete required to make the pipe. *Give answer to nearest cm³.*

326.725636×240
$= 78414.15$

$\therefore 78414\ cm^3$

OR $327 \times 240 = 78480\ cm^3$
$326.758 \times 240 = 78422\ cm^3$

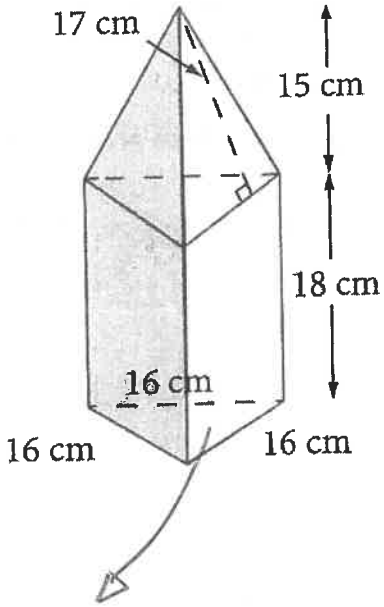
d) How many cubic metres of concrete are required to make 100 of these pipes?
Round answer up to the nearest m³.

$7.8\ m^3 \therefore 8\ m^3$

$7841400\ cm^3$
$(\div 1000000)$

Question 10. [5 marks]

This foam structure is part of a child's toy. The dimensions are shown in the diagram on the right. It consists of two sections: a triangular pyramid and a triangular prism sewn together. The faces need to be covered in fabric. Calculate the total amount of fabric required to completely cover the outside of this foam structure.



Δ Pyramid $= \frac{1}{2} \times 16 \times 8 \times 17$

$= 408$ ✓

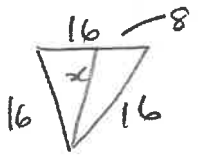
Δ Prism $= 3 \times 18 \times 16$

$= 864$ ✓

Δ Base $= \frac{1}{2} \times 16 \times 8 \times 13.8564$

$= 110.85$ ✓

Total 1382.85 cm^2 ✓



$16^2 - 8^2 = x^2$

$x^2 = 192$

$x = 13.8564$ ✓

End of Calculator Assumed Section