CARLINGFORD HIGH SCHOOL

NAME: Solutions

Teacher: _____

2021

Semester 2/Term 4
YEARLY
EXAMINATION

Year 9 (5.3) Mathematics

General Instructions

- Write using black or blue pen.
- Time allowed: 50 minutes
- NESA approved calculators may be used.
- Show relevant mathematical reasoning and/or calculations.
- Marks may be deducted for incorrect working or no working.

TOPICS	MARKS	
Linear Relationships	/8	3.8
Geometry	/9	4.4
Surface Area & Volume	/9	4.5
Equations	/9	5.2
Trigonometry	/7	3.9
Indices	/8	4.4
TOTAL	**/50**	

VL – page 1,2 SS – p3,4
PW – page 5,6,7
GT – page 8,9,10

Linear Relationships (8 marks)

1. Find the equation of the line, in general form, through the origin and perpendicular to $y = 7x - 5$. 2

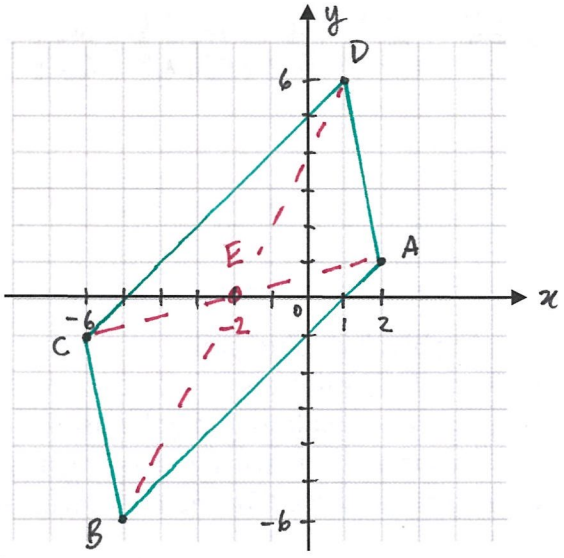
$m_1 = 7 \quad \therefore \quad m_2 = -\frac{1}{7}$ ✓

$y = -\frac{1}{7}x$

$7y = -x \quad \therefore$ In general form : $\boxed{x + 7y = 0}$ ✓

2. A(2, 1), B(-5, -6), C(-6, - 1) and D(1, 6) form a parallelogram.

(i) Plot points A, B, C and D on the number plane below 1



✓

(ii) Find the gradient of AB

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-6-1}{-5-2} = \boxed{1}$ ✓ 1

(iii) Show that the equation of AB is: $x - y - 1 = 0$ 1

$A(2, 1) \quad m = 1$

$y - y_1 = m(x - x_1)$

$y - 1 = 1(x - 2)$ ✓

$y - 1 = x - 2$

$\therefore \quad x - y - 1 = 0$

(iv) Find the exact length of AB 1

$A(2,1)$ $B(-5,-6)$

$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$= \sqrt{(-5-2)^2+(-6-1)^2}$

$= \boxed{\sqrt{98}}$ ✓

(v) Find the coordinates where the diagonals of ABCD intersect. Label it as point E on your diagram. 2

The diagonals bisect each other. So find the midpoint of AC or BD.

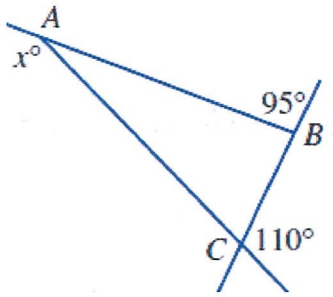
$A(2,1)$ $C(-6,-1)$

$M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = \left(\frac{2-6}{2}, \frac{1-1}{2}\right) = \boxed{(-2,0)}$ ✓

* Label E on number plane. ✓

Geometry (9 marks)

1. Find the value of x, giving reasons. 2



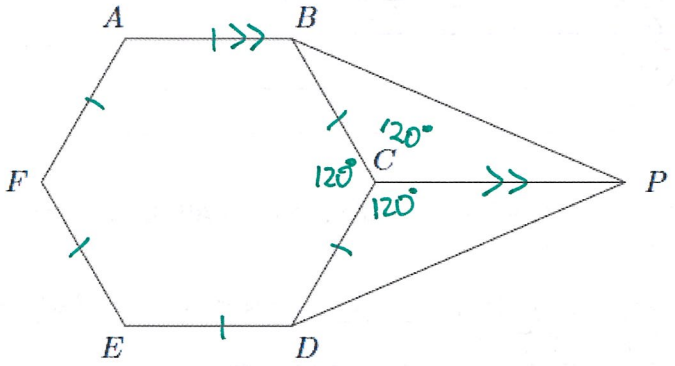
$\angle ACB = 180-110 = 70^\circ$ (angles on a straight line) } ✓

$\angle ABC = 180-95 = 85^\circ$ (" " " ") }

$\therefore x = 70+85$

$= \boxed{155^\circ}$ (exterior angle of a triangle) ✓

2. $ABCDEF$ Is a regular hexagon, and $CP \parallel AB$.



i. Find the size of $\angle BCP$, giving reasons. 2

$\angle BCP = \angle ABC$ (alternate angles on parallel lines : $CP \parallel AB$) ✓

$\angle ABC = \frac{180(6-2)}{6} = 120°$

$\therefore \angle BCP = \boxed{120°}$ ✓

ii. Prove that $\triangle BCP \equiv \triangle DCP$. 3

$\angle BCD = \angle ABC = 120°$ (interior angle of a regular hexagon)

$\angle BCP + \angle BCD + \angle DCP = 360°$

$120 + 120 + \angle DCP = 360$

$\therefore \angle DCP = 120°$ ✓

In $\triangle BCP$ and $\triangle DCP$:

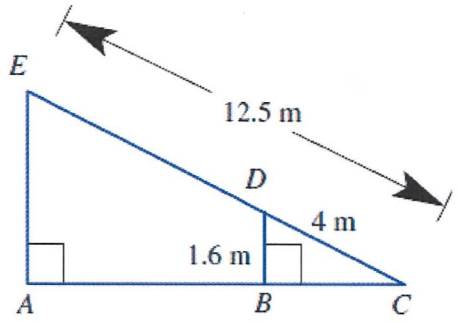
$\angle BCP = \angle DCP = 120°$ ✓

CP is common

$BC = CD$ (sides are equal for a regular hexagon)

$\therefore \triangle BCP \equiv \triangle DCP$ (SAS) ✓

3. A conveyor belt loading luggage onto a plane is 12.5 m long. A vertical support 1.6 m high is placed under the conveyor belt so that it is 4 m along the conveyor belt as shown.



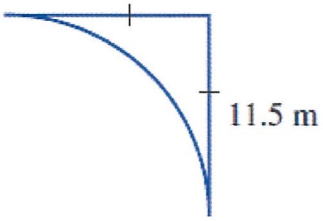
Find the height (AE) of the luggage door above the ground. 2

$\frac{AE}{1.6} = \frac{12.5}{4}$ ✓

$AE = \frac{12.5}{4} \times 1.6 =$ **5 m** ✓

Surface Area and Volume (9 marks)

1. Find the perimeter of this shape. Express your answer to 1 decimal place. 2

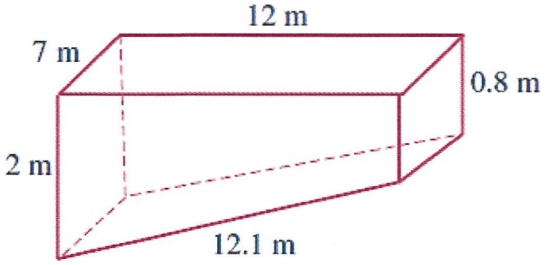


Arc $= \frac{2\pi r}{4} = \frac{2 \times \pi \times 11.5}{4} = 18.06$ m ✓

$\therefore$ Perimeter $= 18.06 + 11.5 \times 2 =$ **41.1 m** ✓

4

2. The sides and floor of this swimming pool are to be tiled. The tiles cost $22 per square metre and there is a further charge of $1500 for labour.



(i) Calculate the area to be tiled. 2

$A = 2[\frac{1}{2} \times 12 \times (0.8+2)] + (7\times2) + (7\times0.8) + (7\times12.1)$ ✓

$= 33.6 + 14 + 5.6 + 84.7$

$= \boxed{137.9\ m^2}$ ✓

(ii) Find the cost of tiling the pool. 1

cost $= \$22 \times 137.9 + 1500$

$= \boxed{\$4533.80}$

(iii) Find the volume of the pool. 1

$V = Ah$

$= \frac{1}{2} \times 12 \times (0.8+2) \times 7$

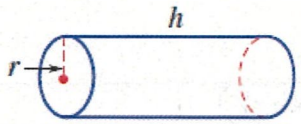
$= \boxed{117.6\ m^3}$

(iv) How many litres of water is needed to completely fill the pool? 1

$117.6 \times 1000 = \boxed{117600\ L}$

(5)

3. A closed cylinder has a **curved surface area** of 72π cm^2 and a height of 6 cm.



Calculate the radius of the cylinder. Must show working. 2

$2\pi rh = 72\pi$ ✓

$2\pi r(6) = 72\pi$

$12\pi r = 72\pi$

$r = \frac{72\pi}{12\pi} = 6$ cm ✓

Equations (9 marks)

1. Solve: 2

$8(3x-2)-2(5-4x)+58=0$

$24x - 16 - 10 + 8x + 58 = 0$ ✓

$32x + 32 = 0$

$x = -1$ ✓

2. Solve: 1

$\frac{5e}{6} - 3 = 12$

$\frac{5e}{6} = 15$

$5e = 15 \times 6$

$e = 18$ ✓

3. Solve: 2

$$\frac{6-x}{3} = \frac{2x-1}{5}$$

$5(6-x) = 3(2x-1)$ ✓

$30 - 5x = 6x - 3$

$33 = 11x$

$x = 3$ ✓

4. 2

The area of an equilateral triangle of side x cm is given by the formula $A = \frac{\sqrt{3}}{4}x^2$.

Find, correct to 2 decimal places, the side length of an equilateral triangle with an area 30 cm^2.

$\frac{\sqrt{3}}{4}x^2 = 30$

$x^2 = 30 \div \frac{\sqrt{3}}{4}$

$x^2 = 69.282\ldots$ ✓

$x = 8.32$ cm $(x > 0)$ ✓

5. Make x the subject 2

$$t = \frac{x}{x-3}$$

$t(x-3) = x$

$tx - 3t = x$

$tx - x = 3t$ ✓

$x(t-1) = 3t$

$x = \frac{3t}{t-1}$ ✓

Trigonometry (7 marks)

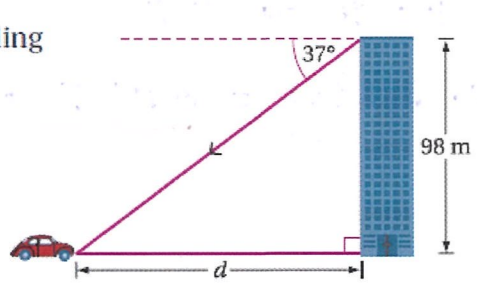
1. A ski slope of length 815 m has a vertical drop of 320 m. Calculate the angle between the ski slope and the horizontal. Round your answer to the nearest minute. 2

$\sin\theta = \frac{320}{815}$ ✓

Must be rounded correctly.

$\theta = 23°7'$ ✓

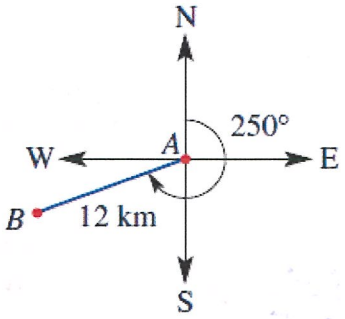
2. From a point on top of a building that is 98 m tall, the angle of depression of a car is 37°. How far is the car from the foot of the building? Give your answer correct to the nearest metre. 2

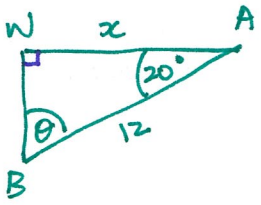


$\tan 37° = \frac{98}{d}$ ✓

$d = \frac{98}{\tan 37} = 130\text{ m}$ ✓

3. Two towns, A and B, are 12 km apart. The bearing of B from A is 250°.





Must be rounded correctly to 3 s.f.

(i) How far west of A is B, correct to 3 significant figures? 2

$\cos 20^\circ = \frac{x}{12}$ ✓

$x = 12\cos 20^\circ = 11.2763\ldots = \boxed{11.3 \text{ km}}$ ✓

(ii) Find the bearing of A from B. 1

$\theta = 90 - 20 = 70$

$\therefore$ Bearing = 070° T or N70°E ✓

Indices (8 marks)

1. Simplify: 1

$3p^4 \times 4p^5 \times 3p$ $\quad 36p^{10}$ ✓

2. Simplify: 1

$(8g)^0 + 8g^0 \quad = 1 + 8 = 9$ ✓

3. Simplify: 2

$$\frac{5d^2 \times 2\,d^2e^2}{(2d)^4} = \frac{10d^4e^2}{16d^4} = \frac{5e^2}{8}$$

✓ ✓

4. Simplify, writing your answer with positive indices. 2

$$a^5b^{-4} \times a^{-3}b^{-5}$$

$= a^2b^{-9}$ ✓

$= \frac{a^2}{b^9}$ ✓

5. Write in index form: 1

$$\frac{1}{x \times \sqrt[3]{x}} = \frac{1}{x \times x^{\frac{1}{3}}} = \frac{1}{x^{4/3}} = x^{-\frac{4}{3}}$$

✓

6. The distance from Earth to the moon is approximately 3.844×10^5 km. 1
If you could drive there without breaking the speed limit of 110 km/h, how many days would it take?

$3.844 \times 10^5 \div 110$

$= 3494.55$ hours

$=$ 146 days ✓

END OF EXAM