

Carlingford High School



Mathematics

Year 9 5.3 Term 3 Examination

2019

Time allowed: 50 minutes

Name: Answers Class: 9MAT3__

Please circle your
teacher:

Mrs Wilson/
Mrs Young

Mrs Lego

Mr Wilson

Instructions:

- Use blue or black pen
- Pencil may be used for graphs or diagrams only
- Board approved calculators may be used
- No lending or borrowing
- Show all necessary working out in the space provided
- Marks may be deducted for untidy setting out
- All questions are worth one mark unless otherwise shown

Topic	Factorising	Trigonometry	Surds	Problem Solving	Total	
Mark	/18 20	/22	/20	/2	/62 64	%

²⁰
Factorising (18 marks)

1. Fully factorise the following.

a) $x^2 - 36$
 $(x+6)(x-6)$

b) $6ab - 24bc + 6ad - 24cd$
 $= 6b(a-4c) + 6d(a-4c)$
 $= 6(b+d)(a-4c)$ 2
(1 mark if 6 not taken out)

c) $(p+2q)^2 - 4q^2$
 $= (p+2q-2q)(p+2q+2q)$
 $= p(p+4q)$ 2

2. Factorise each quadratic expression.

a) $a^2 + 7a + 12$
 $= (a+3)(a+4)$

b) $m^2 - m - 20$
 $= (m-5)(m+4)$

c) $32 - 8c + \frac{c^2}{2}$
 $= \frac{1}{2}(c^2 - 16c + 64)$
 $= \frac{1}{2}(c-8)^2$ 2

d) $8d^2 + 10d - 3$
 $= 8d^2 - 2d + 12d - 3$
 $= 2d(4d-1) + 3(4d-1)$
 $= (2d+3)(4d-1)$ 2

3. Simplify each expression fully.

a) $\frac{k^2+3k+2}{3k+6}$ 2
 $= \frac{(k+1)(k+2)}{3(k+2)}$
 $= \frac{k+1}{3}$

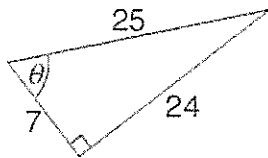
b) $\frac{6+18t}{1-2t} \times \frac{1+2t}{10+30t}$ 2
 $= \frac{6(1+3t)}{1-2t} \times \frac{1+2t}{10(1+3t)}$
 $= \frac{3(1+2t)}{5(1-2t)}$

c) $\frac{5x^2-80}{x^2-3x-4} \div \frac{3x^3+12x^2}{x^2+x}$ 2
 $= \frac{5(x+4)(x-4)}{(x+1)(x-4)} \times \frac{x(x+1)}{3x^2(x+4)}$
 $= \frac{5}{3x}$

d) $\frac{2}{h^2+h-6} + \frac{1}{h^2-4h+4}$ 3
 $= \frac{2}{(h+3)(h-2)} + \frac{1}{(h-2)^2}$
 $= \frac{2(h-2) + h+3}{(h+3)(h-2)^2}$
 $= \frac{3h-1}{(h+3)(h-2)^2}$

Trigonometry (22 marks)

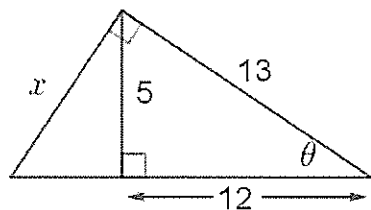
1. Complete the ratios for the triangle below, giving your answers as fractions. 2



$$\sin \theta = \frac{24}{25}$$

$$\cos \theta = \frac{7}{25}$$

2. 4. Find the value of θ , correct to the nearest minute. 2



- a) In the triangle with hypotenuse of length 13, $\tan \theta = \frac{5}{12}$

- b) Use your answer for a) and an expression for $\tan \theta$ in the larger triangle to give the value of x as a fraction.

$$\tan \theta = \frac{x}{13}$$

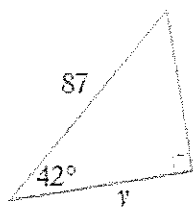
$$\text{From a) } \frac{x}{13} = \frac{5}{12}$$

$$x = \frac{5 \times 13}{12}$$

$$= \frac{65}{12} \text{ or } 12\frac{5}{12}$$

3. Calculate, correct to one decimal place, the value of each pronumeral. 2

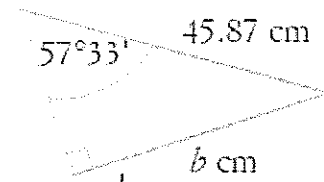
- a)



$$\cos 42^\circ = \frac{y}{87}$$

$$\begin{aligned} y &= 87 \cos 42^\circ \\ &= 64.65359... \\ &= 64.7 \end{aligned}$$

- b)

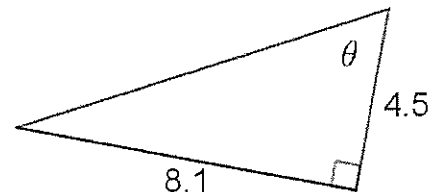


$$\sin(57^\circ 33') = \frac{b}{45.87}$$

$$b = 45.87 \sin(57^\circ 33')$$

$$= 38.70785...$$

$$= 38.7 \text{ cm}$$



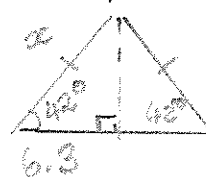
$$\tan \theta = \left(\frac{8.1}{4.5} \right)$$

$$\theta = \tan^{-1} \left(\frac{8.1}{4.5} \right)$$

$$= 60.945...$$

$$= 60^\circ 57'$$

5. The base of an isosceles triangle is 12.6 cm long, and each of its base angles is 42° . Find the perimeter of the triangle, correct to one decimal place. 3



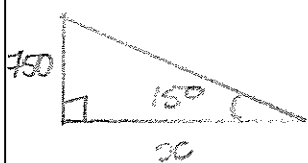
$$x = \frac{6.3}{\cos(42)}$$

$$= 8.477...$$

$$P = 12.6 + 2x$$

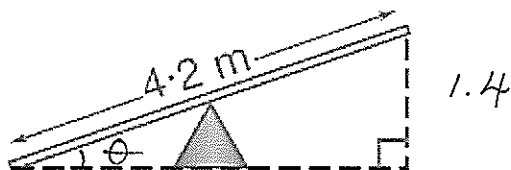
$$= 29.6 \text{ cm}$$

6. A plane is flying at a height of 750 m. 2
If the angle of elevation from an observer at the end of the runway to the plane is 15° , what is the horizontal distance between the plane and the end of the runway, correct to the nearest metre?



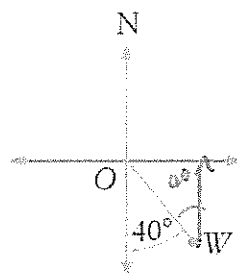
$$\begin{aligned}\tan 15^\circ &= \frac{750}{x} \\ x &= \frac{750}{\tan 15^\circ} \\ &= 2799.038... \\ &= 2799 \text{ m}\end{aligned}$$

7. The beam of a see saw is 4.2 m long. 2
If one end is 1.4 m above the ground at its highest point, find the angle of elevation of the beam, correct to the nearest degree.



$$\begin{aligned}\sin \theta &= \frac{1.4}{4.2} \\ \theta &= \sin^{-1}\left(\frac{1.4}{4.2}\right) \\ &= 19.471... \\ &= 19^\circ\end{aligned}$$

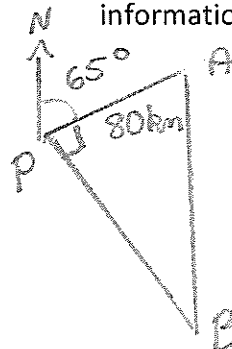
8.



- a) What is the bearing of W from O?
 $180 - 40 = 140^\circ$
- b) What is the bearing of O from W?
 $360 - 40 = 320^\circ$

9. Two fishing boats set out at the same time from port P. The first boat sails on a bearing of 065° while the second sails on a course of 155° . The first boat sails 80 km to point A where it is due north of the second boat at point B.

- a) Draw a diagram representing this information.



- b) Find the distance between the two boats, correct to one decimal place. 2

$$\begin{aligned}\angle B &= 25^\circ \quad (\angle B + 155 = 180 \text{ co-interior angles on parallel lines}) \\ \sin 25^\circ &= \frac{80}{AB} \\ AB &= \frac{80}{\sin 25^\circ} \\ &= 189.296... \\ &= 189.3 \text{ km}\end{aligned}$$

1 mark for finding angle B or A.

20
Surds (18 marks)

1. Circle all irrational numbers.

1. $\dot{8}$, $\left(\frac{3\pi}{4}\right)$, $\sqrt{144}$, $\frac{22}{7}$, $\left(\sqrt{20}\right)$

2

2. Simplify the following.

a) $\sqrt{12} = \sqrt{3} \times \sqrt{4}$
 $= 2\sqrt{3}$

b) $(3\sqrt{11})^2 = 9 \times 11$
 $= 99$

3. Simplify fully.

a) $4\sqrt{3} - 3\sqrt{2} + \sqrt{3} = 5\sqrt{3} - 3\sqrt{2}$

b) $7\sqrt{6} - 2\sqrt{24} = 7\sqrt{6} - 4\sqrt{6}$
 $= 3\sqrt{6}$

2

c) $5\sqrt{3} \times 4\sqrt{2} = 20\sqrt{6}$

d) $\frac{\sqrt{1500}}{\sqrt{54} \times \sqrt{150}}$
 $= \frac{2\sqrt{15}}{3\sqrt{6} \times \sqrt{6}}$
 $= \frac{2\sqrt{15}}{18}$

2

4. Expand and simplify.

a) $\sqrt{2}(3\sqrt{3} - \sqrt{7})$
 $= 3\sqrt{6} - \sqrt{14}$

b) $(\sqrt{2} + 1)(3\sqrt{2} + 4)$
 $= 6 + 4\sqrt{2} + 3\sqrt{2} + 4$
 $= 10 + 7\sqrt{2}$

2

c) $(\sqrt{5} - 2\sqrt{3})^2$
 $= 5 - 4\sqrt{15} + 12$
 $= 17 - 4\sqrt{15}$

2

5. Simplify, giving your answer with a rational denominator.

a) $\frac{\sqrt{3}}{\sqrt{21}} = \frac{1}{\sqrt{7}}$
 $= \frac{\sqrt{7}}{7}$

b) $\frac{1}{2\sqrt{3}} + \frac{\sqrt{2}}{\sqrt{5}}$
 $= \frac{\sqrt{3}}{6} + \frac{\sqrt{10}}{5}$
 $= \frac{5\sqrt{3} + 6\sqrt{10}}{30}$

2

c) $\frac{1}{4-2\sqrt{2}} - \frac{1}{3+2\sqrt{2}}$
 $= \frac{4+2\sqrt{2}}{16-8} - \frac{3-2\sqrt{2}}{9-8}$
 $= \frac{2+\sqrt{2}}{4} - \frac{4(3-2\sqrt{2})}{4}$

2

$= \frac{-10 + 9\sqrt{2}}{4}$

Problem Solving (2 marks)

1. Find the smallest integer n such that $\sqrt{\frac{n}{3}}$ and $\sqrt[3]{4n}$ are both integers.

$$\frac{n}{3} = 3^2 x^2$$

$$n = 27x^2 \text{ or } 3^3 x^2$$

$$4n = 2^3 y^3$$

$$n = 2y^3$$

$$= 2 \times 2^3 3^3$$

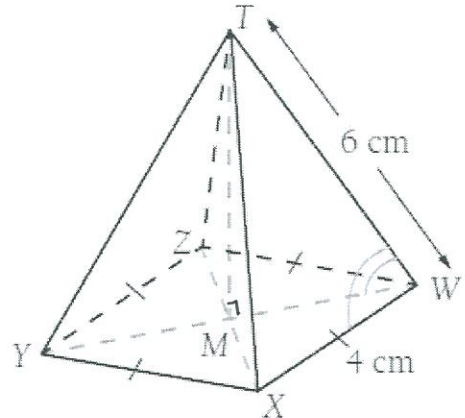
$$= 2^4 \times 3^3$$

$$= 432$$

allow either

Also allow '0'
since question did not
state positive integer.

2. The diagram shows a square pyramid whose base edges are 4 cm and slant edges are 6 cm. Find the exact value of $\cos(\angle TWM)$.



$$YW^2 = 16 + 16$$

$$= 32$$

$$YW = 4\sqrt{2}$$

$$MW = 2\sqrt{2}$$

$$\cos(\angle TWM) = \frac{2\sqrt{2}}{6}$$

$$= \frac{\sqrt{2}}{3}$$

End of Exam - Please check your work.