



**2015** PRELIMINARY  
TASK 3 EXAMINATION

# Mathematics

## General Instructions

- Reading time – 3 minutes
- Working time – 57 minutes
- Write using blue or black pen
- Black pen is preferred
- Board-approved calculators may be used
- In Questions 5-6, show relevant mathematical reasoning and/or calculations

Total Marks – 34

### Section I

4 marks

- Attempt questions 1-4
- Allow about 7 minutes for this section

### Section II

30 marks

- Attempt questions 5-6
- Allow about 50 minutes for this section

## Section I

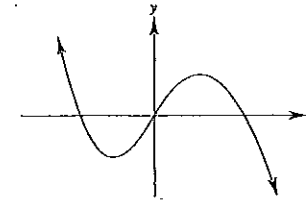
4 marks

Attempt Questions 1-4

Allow about 7 minutes for this section

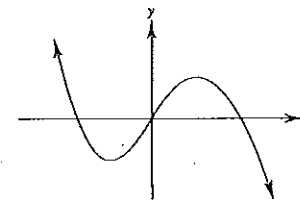
Use the multiple-choice answer sheet for Questions 1-4.

1

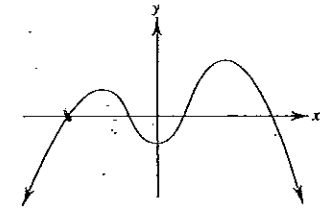


The gradient function for this graph could be:

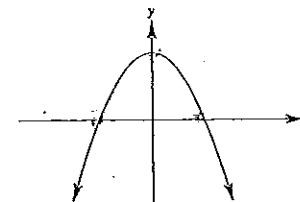
(A)



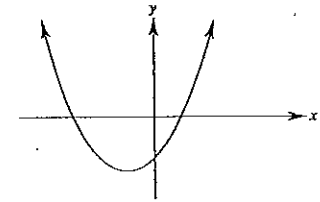
(B)

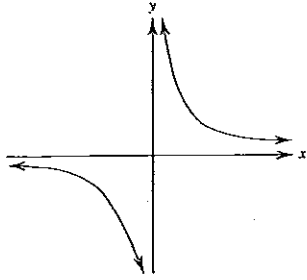


(C)



(D)





For the function shown above, which statement is NOT true?

- (A) The function is not differentiable at  $x = 0$ .  
 (B) This function is not continuous at  $x = 0$ .  
 (C) The gradient at  $x = 0$  is zero.  
 (D) This function has an asymptote at  $x = 0$ .

3  $\lim_{\delta x \rightarrow 0} \frac{x^2 \delta x^2 - 2x \delta x}{\delta x} =$

- (A)  $-2x$       (B)  $-2$       (C)  $0$       (D)  $-1$

4  $\frac{d}{dx} \frac{2x^3 + 5x}{x} =$

- (A)  $\frac{x(2x^2+5)}{x}$       (B)  $4x + 5$   
 (C)  $4x$       (D)  $2x$

End of Section I

## Section II

30 marks

Attempt Questions 5-6

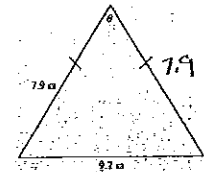
Allow about 50 minutes for this section

Answer each question on a new answer sheet. Extra answer sheets are available.

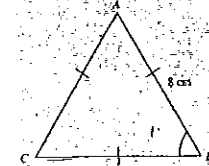
In Questions 5-6, your responses should include relevant mathematical reasoning and/or calculations.

Question 5 (15 marks) Use the Writing Booklet.

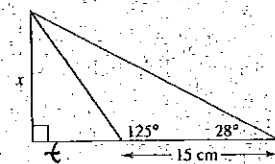
- (a) A ship sails on a bearing of  $215^\circ$  from port until it is 100km due south of port. How far does it sail, to the nearest km? 2  
 (b) Solve  $2 \cos(\theta + 10^\circ) = -1$  for  $0^\circ \leq \theta \leq 360^\circ$  3  
 (c) Find the value of  $b$  if  $\sin b = \cos(2b - 30)^\circ$ . 2  
 (d) Prove that  $\frac{2 \cos^2 \theta}{1 - \sin \theta} = 2 + 2 \sin \theta$ . 2  
 (e) Find  $\theta$  to the nearest minute. 2



- (f) Find the exact area of  $\triangle ABC$ . 2



- (g) Find the value of  $x$ . 2



End of Question 5

**Question 6** (15 marks) Use the Writing Booklet.

- (a) Find the gradient of  $2x - y + 1$  1
- (b) Find the gradient of a line that is perpendicular to  $5x + 3y - 8 = 0$ . 2
- (c) A straight line makes an angle of  $153^\circ 29'$  with the  $x$ -axis in the positive direction. What is its gradient, to 3 significant figures? 2
- (d) Prove that lines  $y = 5x - 7$  and  $10x - 2y + 1 = 0$  are parallel. 2
- (e) Find the equation of the line with  $y$ -intercept  $-2$  and perpendicular to the line passing through  $(3, -2)$  and  $(0, 5)$ . 3
- (f) The perpendicular distance from  $(3, -2)$  to the line  $5x - 12y + c = 0$ . Find two possible values of  $c$ . 2
- (g) Find the equation of the straight line through  $(1, 3)$  that passes through the intersection of the lines  $2x - y + 5 = 0$  and  $x + 2y - 5 = 0$  3

**End of paper**

Student Name \_\_\_\_\_ Teacher \_\_\_\_\_

2015 Preliminary 2U Mathematics Task 3  
Multiple Choice Answer Sheet

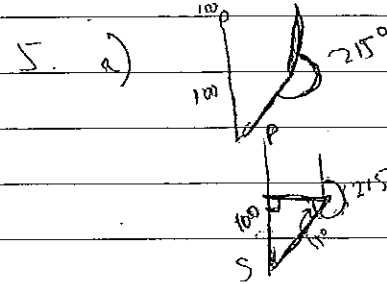
Completely fill the response oval representing the most correct answer.

1. A  B  C  D
2. A  B  C  D
3. A  B  C  D
4. A  B  C  D

Name \_\_\_\_\_ Class \_\_\_\_\_

Question \_\_\_\_\_

Section 2



②  $\sin 55^\circ = \frac{100}{h}$

$h = 122 \text{ km}$  - Distance travelled

b)  $2(\cos(\theta + 10^\circ)) = -1$   $2\cos(\theta + 10^\circ) = -1$

$\cos(\theta + 10^\circ) = -\frac{1}{2}$

③  $\cos(\theta + 10^\circ) = 120^\circ, 240^\circ$

c)  $\sin b = \cos(2b - 30^\circ)$   $\theta = 110^\circ, 230^\circ$

$\sin b = \cos(2b - 30^\circ)$

$\therefore b = \dots$

$b + 2b - 30 = 90$

$3b - 30 = 90$

$3b = 120$

$b = 40^\circ$  ✓

Prove:

$$d) \frac{2\cos^2\theta}{1-\sin\theta} = 2+2\sin\theta$$

$$\frac{2\cos^2\theta}{1-\sin\theta} = 2+2\sin\theta$$

$$\frac{2(1-\sin^2\theta)}{(1-\sin\theta)(1+\sin\theta)}$$

$$(1-\sin\theta)(1+\sin\theta)$$

$$\frac{2(1-\sin^2\theta) \times (1+\sin\theta)}{1-\sin\theta \times (1+\sin\theta)}$$

Answer

$$\frac{2-2\sin^2\theta}{1-\sin\theta}$$

$$\frac{2(1-\sin^2\theta)(1+\sin\theta)}{(1-\sin\theta)(1+\sin\theta)} = \text{LHS}$$

$$\therefore \text{RHS} = \text{LHS}$$

$$\text{②} \quad \frac{2(1-\sin^2\theta)}{1-\sin\theta} = (2+2\sin\theta)$$

e)  $\theta = 75^\circ 45'$

$$c^2 = b^2 + a^2 - 2ab \cos A$$

$$A) \frac{1}{2} AB \sin C$$

$$4.7^2 + 7.9^2 - 2 \times 4.7 \times 7.9 \cos A$$

$$\frac{1}{2} \times 8 \times 8 \times \sin 60^\circ$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$= 32 \times \frac{\sqrt{3}}{2}$$

$$\cos A = \frac{7.9^2 + 7.9^2 - 9.7^2}{2 \times 7.9^2}$$

$$\frac{32\sqrt{3}}{2} = 16\sqrt{3} \text{ cm}^2$$

$$\cos A = 0.246$$

$$\theta = 75^\circ 45'$$

②

②

g)  $\tan 28^\circ = \frac{x}{15+t}$       $x = (15+t) \tan 28^\circ$

$$\tan 55^\circ = \frac{x}{t} \quad x = t \tan 55^\circ$$

$$(15+t) \tan 28^\circ = t \tan 55^\circ$$

$$7.98 + 0.53t = 1.43t$$

$$7.98 = 0.9t$$

$$t = 8.9$$

and  $\tan 55^\circ = \frac{x}{t}$

②

$$x = 8.9 \times \tan 55^\circ$$

$$= 12.7 \text{ cm (to one decimal pt.)}$$

Question 6

a)  $2x - y + 1 = 0$

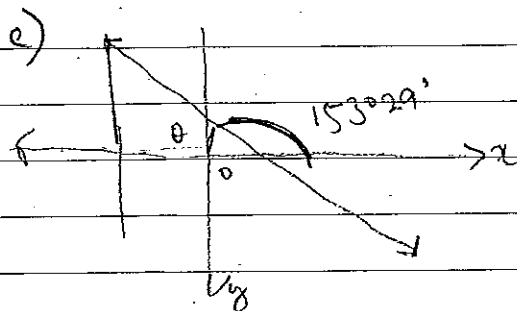
$$y = 2x + 1 \quad m = 2$$

①

b)  $y = \frac{-5x + 8}{3}$       $\therefore$  gradient of normal

$$\text{is } \frac{3}{5}$$

②



$$\theta = 26^\circ 31'$$

$$\therefore \tan (26^\circ 31')$$

$$= 0.50$$

①

d)  $y = 5x - 7$  (1)  $y = \frac{10x + 1}{2}$  (2)  
 $m_1 = 5$   $m_2 = 5$   
 $M_1 = M_2 \therefore$  parallel

(2)

e)  $M_1 = \frac{7}{-3}$   
 $\therefore y - 2 = \frac{7}{-3}(x - 0)$

$y - 2 = \frac{3x}{7}$

$7y - 14 = 3x$

$3x - 7y + 14 = 0$

(3)

f)  $\frac{15 + 24 + c}{\sqrt{169}} = \frac{15 + 24 + c}{13} = 0$

Possibility 2

Possibility 1:  $\frac{-15 - 24 - c}{13} = 0$  or  $\frac{15 + 24 + c}{13}$

(1)

$c = -39$  or  $c = 39$

g) (1, 3)  
 $2x - y + 5 = 0$  (1)  
 $x + 2y - 5 = 0$  (2)

(3)  $x = -2y + 5$

(4)  $2(-2y + 5) - y + 5 = 0$

$-4y + 10 - y + 5 = 0$

$-5y + 15 = 0$

$y = 3$

then sub in to (2)

$x + 6 - 5 = 0$

$x = -1$

check in to (1)

$-2 + 3 - 5 = 0 \checkmark$

$\therefore (-1, 3) (1, 3)$

$m_1 = 0$

$\therefore y = 3$

(3)

