

**REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF MINERAL RESOURCES
EXAMINATION FOR THE MINE SURVEYOR'S CERTIFICATE OF COMPETENCY**

DATE: 10 October 2012 (Wednesday)
TIME: 8:30 to 11:30 (3 Hours)

TOTAL MARKS: 100
TO PASS: 50

MATHEMATICS

- Note: (1) The make and model number of your calculator must be shown on the front cover of your answer book.
(2) All steps must be shown.

QUESTION 1

Find $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ if :

$$f(x) = -3x^2 + 4x$$

[5 marks]

QUESTION 2

- (a) Insert four terms between 1 and $\frac{32}{243}$ such that the six terms form a geometric sequence. (6)
- (b) Find the 1st and 8th terms of the geometric sequence whose 4th and 5th terms are 4 and 6 respectively. (6)

[12 marks]

QUESTION 3

Simplify :

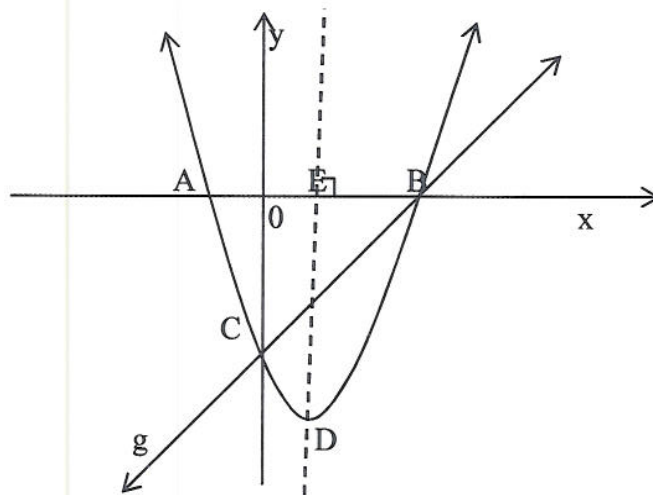
- (a) $\frac{6^{6x} \cdot 9^{3x}}{54^{4x} \cdot (\frac{1}{4})^{2-x}}$ (5)

(b) $\frac{\sqrt{x+1} - \sqrt{x-1}}{\sqrt{x+1} + \sqrt{x-1}}$ (5)

(c) $\frac{a^{x+3} + 2a^x \cdot (a^x - 2)}{a^{3x} - 4a^x}$ (4)

[14 marks]

QUESTION 4



The above sketch shows, roughly, the graphs of $y = x^2 - 4x - 5$ and a linear function g . The dotted line is parallel to the y -axis and perpendicular to the x -axis at point E .

- (a) Find the lengths of OA , OB , OC , OE and ED . (11)
 (b) What is the equation of the dotted line? (2)
 (c) What is the length of BC ? (3)
 (d) Find an equation for g . (4)

[20 marks]

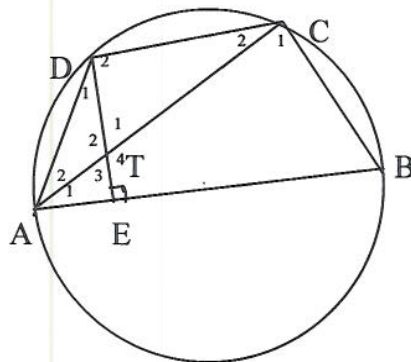
QUESTION 5

An empty tramming locomotive on an underground mine travels 5 km/h faster than when it is loaded with ore. If the total distance between the loading and the tipping points is 5 kilometres and the empty loco completes the journey 10 minutes quicker than when loaded, determine the speed of the loaded locomotive.

Assume that the tunnel has a level grade.

[10 marks]

QUESTION 6



In the sketch AB is the diameter of the circle.

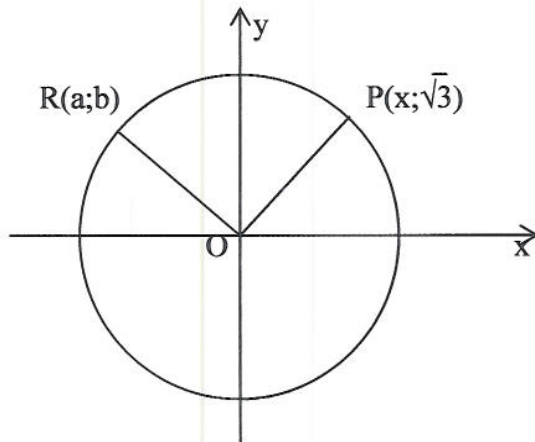
D and C are points on the circle and $DE \perp AB$. DE and AC cut one another at point T.

Prove that:

- (a) angle $D_1 = \text{angle } C_2$ (6)
- (b) angle $T_1 = \text{angle } B$ (3)
- (c) $DA^2 = AT \cdot AC$ (5)
- (d) $DA^2 = AE \cdot AB$ (6)

[20 marks]

QUESTION 7



The radius of a circle, with centre O, is 2 units.

$R(a;b)$ and $P(x;\sqrt{3})$ are points on the circle. Angle $XOP = \theta$ and angle $ROP = 90^\circ$.

Determine the value(s) of:

- (a) x
- (b) $\sin \theta$ and hence θ
- (c) $\tan(360^\circ - \theta)$
- (d) $\tan(90^\circ + \theta)$
- (e) a and b .

[12 marks]

QUESTION 8

Prove that:

$$\cot 54^\circ \cdot \operatorname{cosec} 144^\circ + \sec 144^\circ \cdot \cos^2 126^\circ = \cos 36^\circ$$

[7 marks]

TOTAL [100 Marks]