



mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

MINE SURVEYOR'S CERTIFICATE OF COMPETENCY EXAMINATION

MATHEMATICS

DATE: 08 OCTOBER 2014

TOTAL MARKS: 100
TO PASS: 50

TIME ALLOWED: 3 HOURS
(08h30 to 11h30)

NOTE:

- This question paper consists of **FIVE** pages including cover page.
- All questions must be answered.
- All answers and sketches to be presented in a neat and decipherable manner. Papers will not be marked if not decipherable.
- Restrict the use of highlighters.
- Do not use a red pen.
- Read the instructions on the front page of your answer book carefully.
- No cellular phones shall be allowed in the examination venue.
- The use of computers, laptops and palmtops is prohibited.
- The make and model of your calculator must be shown on the front cover of your answer book.
- All steps must be shown.

QUESTION 1

Differentiate the following using first principles:

(a) $f(x) = 2x - x^2$ (6)

(b) $f(x) = -3x^2 + 4x$ (6)

[12 marks]

QUESTION 2

(a) Calculate m if

$$\sum_{i=5}^{20} (3i - 4m) = 472$$

(5)

(b) Prove that $\frac{2a-1}{3}; \frac{2a-1}{2}; \frac{2(2a-1)}{3}; \dots$ is an arithmetic sequence. (6)

[11 marks]

QUESTION 3

(a) Determine the co-ordinates of the centre and radius of the circle given by:

$$x^2 + 2x + y^2 - 6y = 6$$
 (4)

(b) Determine the equation of a straight line which is perpendicular to the line $y = x - 3$, and which passes through point $(1;2)$. (4)

[8 marks]

QUESTION 4

Find the Highest Common Factor (HCF) of the following:

$$\begin{aligned} &3px^2 + 3px - 18, \\ &15px^2 - 60px + 60p, \\ &2px - 4p \end{aligned}$$

[5 marks]

QUESTION 5

Solve for x:

(a) $2^x + 2^{1-x} - 8 = 2^{-2}$ (6)

(b) $\frac{3 \cdot 2^{2x-1} - 2^{2x+1}}{4^x} = 2^{-3x} - 1$ (4)

(c) $\log_7 7^{x-1} = (x-1)^7$ (6)

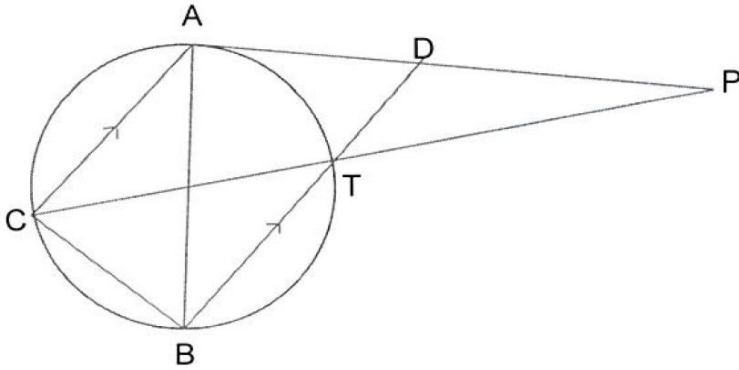
[16 marks]

QUESTION 6

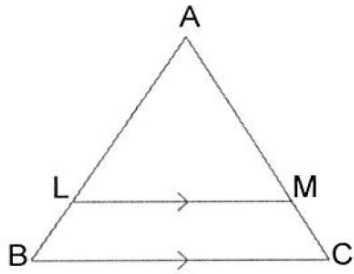
(a) In the figure below, PA is a tangent and CA // BT.
Prove that:

(i) Triangle ABC // triangle ADT (5)

(ii) PT is a tangent to circle ADT. (5)



(b)



If $AB = 24\text{mm}$ and $AL:LB = 5:3$, calculate AL and LB .

(5)

[15 marks]

QUESTION 7

Express $\frac{2x + 5}{(x + 2)(x + 3)}$ in partial fractions.

[8 marks]

QUESTION 8

- (a) Without the use of a calculator, determine the value of:

$$\frac{\sin(-120^\circ) \cdot \cos 660^\circ \cdot \tan 315^\circ}{(\cos 310^\circ \cdot \sin 140^\circ) + \sin^2 410^\circ} \quad (8)$$

- (b) Simplify:

$$\frac{\sin(180^\circ - x) \cdot \tan(90^\circ - x)}{\operatorname{cosec}(90^\circ - x) \cdot \cos(360^\circ - x) \cdot \cot(180^\circ - x)} \quad (7)$$

- (c) If $\cot \theta = a$, prove that

$$a + \frac{1}{a} = \operatorname{cosec}(180^\circ - \theta) \cdot \operatorname{cosec}^2(270^\circ - \theta) \cdot \cos(-\theta) \quad (10)$$

[25 marks]

TOTAL [100 marks]

