



**mineral resources**

Department:  
Mineral Resources  
REPUBLIC OF SOUTH AFRICA

## **MINE SURVEYOR'S CERTIFICATE OF COMPETENCY EXAMINATION**

### **MATHEMATICS**

**DATE: 04 OCTOBER 2016**

**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

(a) Prove that  $\frac{2a-1}{3}; \frac{2a-1}{2}; \frac{2(2a-1)}{3}; \dots$  is an arithmetic sequence. (7)

(b) In an arithmetic sequence, the 7<sup>th</sup> term( $T_7$ ) is twice the value of the 11<sup>th</sup> term( $T_{11}$ ), and the 5<sup>th</sup> term( $T_5$ ) = 20.

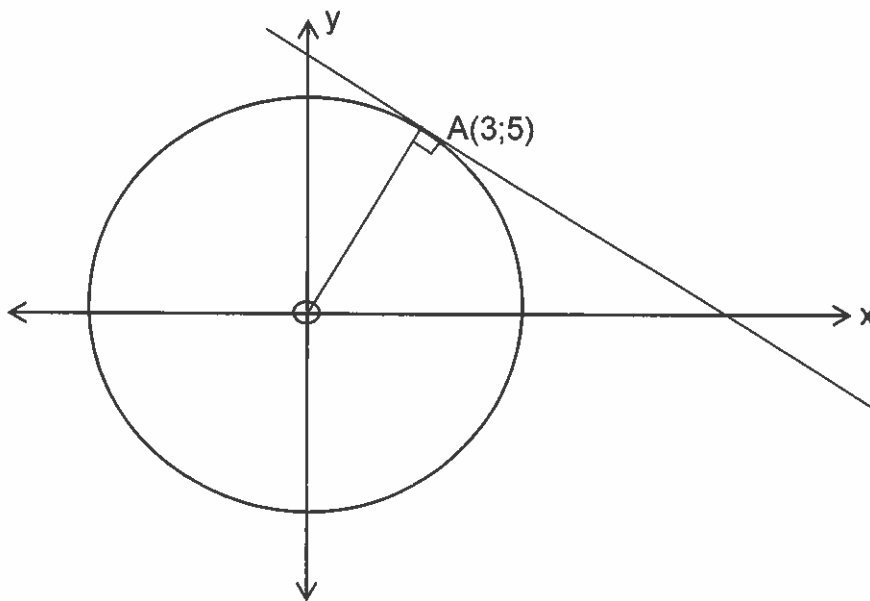
(i) Find the values of a and d.

(ii) Calculate  $T_{20}$ .

(9)

[16 marks]

### QUESTION 2



Determine the equation of the tangent to the circle  $x^2 + y^2 = 34$ , at the point A(3;5).

[9 marks]

### QUESTION 3

Find the limits of the following:

(a)  $\lim_{x \rightarrow 1} (x^3 + 3x^2 - 2x - 17)$

(b)  $\lim_{x \rightarrow 2} \frac{x + 3}{x + 6}$

(c)  $\lim_{h \rightarrow 0} \frac{(3 + h)^2 - 9}{h}$

(d)  $\lim_{x \rightarrow 2} \frac{2x - 4}{x^3 - 2x^2}$

[11 marks]

### QUESTION 4

Find  $\frac{dy}{dx}$  of the following:

(a)  $y = \frac{x^2 - 1}{x^2 + 1}$

(b)  $y = \frac{x^3}{3} + \frac{x^2}{2} + x$

(c)  $y = x^2(x^3 - 1)$

[10 marks]

### QUESTION 5

Solve for x:

(a)  $\frac{3}{x} + x + 5 = \frac{x+3}{x}$  (5)

(b)  $\sqrt{2x+1} = x-7$  (6)

(c)  $4^x = 8^{2x-4}$  (3)

(d)  $3^{x+2} - 3^{x-1} = 78$  (6)

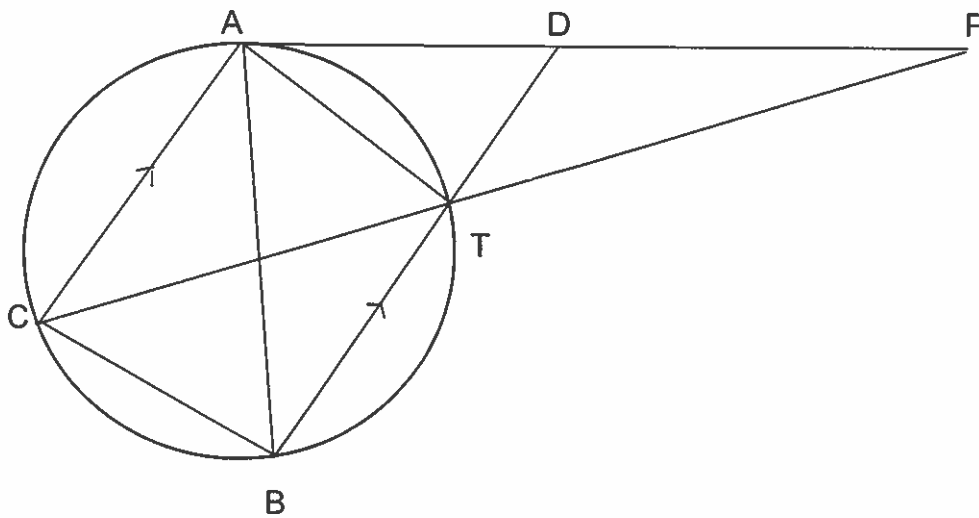
[20 marks]

### QUESTION 6

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

(i)  $\triangle ABC \sim \triangle ADT$  (5)

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



- (b) Given triangle ABC, and angle C is obtuse.  
Prove that  $c^2 = a^2 + b^2 - 2ab \cdot \cos C$

(7)

[17 marks]

### QUESTION 7

- (a) Determine the value of:

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

(7)

- (b) Prove the following identity:

$$\frac{\cos x}{\sin x - 1} - \frac{1}{\tan x - \operatorname{cosec} x \cdot \sec x} = -\sec x$$

(10)

[17 marks]

TOTAL [100 marks]