

MATHEMATICS (TEST 1)

1 (a) (i) $\frac{E}{mh} = g$

✓
(1)

(ii) $\frac{T}{2\pi} = \sqrt{\frac{l}{g}}$

1

Square both sides

1

$$\left(\frac{T}{2\pi}\right)^2 = \frac{l}{g}$$

1

$$g = \frac{l}{\left(\frac{T}{2\pi}\right)^2} \quad (\text{or equivalent})$$

1

(4)

(iii) $v^2 = u^2 + 2gs$

$$v^2 - u^2 = 2gs$$

1

$$\frac{v^2 - u^2}{2s} = g$$

1

(2)

1 (b) (i) 1

7

(ii) $(q^{1/2})^4$

(1)

$$q^2$$

1

(2)

(iii) $(p+q)(3p-q) + (2p+q)(p-q)$
 $3p^2 - pq + 3pq - q^2 + 2p^2 - 2pq + pq - q^2$
 $5p^2 + pq - 2q^2$

1 1 1

(3)

6

1 (c) $\frac{2}{(x+1)} + \frac{3}{(x-4)}$

$$\frac{2(x-4) + 3(x+1)}{(x+1)(x-4)}$$

1

$$\frac{2x - 8 + 3x + 3}{(x+1)(x-4)}$$

1

$$\frac{5x - 5}{(x+1)(x-4)}$$

1

$$\frac{5x - 5}{(x+1)(x-4)}$$

1

$$\frac{5x - 5}{(x+1)(x-4)}$$

$$\frac{A}{(x+1)} + \frac{B}{(x-4)} = \frac{5x-5}{(x+1)(x-4)}$$

$$\frac{A(x-4) + B(x+1)}{(x+1)(x-4)} = \frac{5x-5}{(x+1)(x-4)}$$

Put $x = 4$

$B = 3$

Put $x = -1$

$A = 2$

(d)

(i) $2^{3x-5} = 4^{5x-6}$

take logs to base 10 (or e)

$$\log 2^{3x-5} = \log 4^{5x-6}$$

$$(3x-5)\log 2 = (5x-6)\log 4$$

$$(3x-5)(0.3010) = (5x-6)(0.6021)$$

$$0.903x - 1.505 = 3.0105x - 3.6126$$

$$3.6126 - 1.505 = 3.0105x - 0.903x$$

$$2.1076 = 2.1075x$$

$\therefore x = 1$

(ii) $\ln(x^2-4) - \ln(x+8) = \ln x$

$$\frac{\ln(x^2-4)}{(x+8)} = \ln x$$

$$x^2-4 = x(x+8)$$

$$x^2-4 = x^2+8x$$

$$\therefore x = \underline{\underline{-\frac{1}{2}}}$$

(e)

Let $u = 2-3x$

Let $v = 1-5x^2$

$\therefore u' = -3$

$v' = -10x$

Using Quotient Rule

$$y' = \frac{(1-5x^2)(-3) - (2-3x)(-10x)}{(1-5x^2)^2}$$

1(e)
(continued)

$$y' = \frac{-3 + 15x^2 + 20x - 30x^2}{(1 - 5x^2)^2}$$

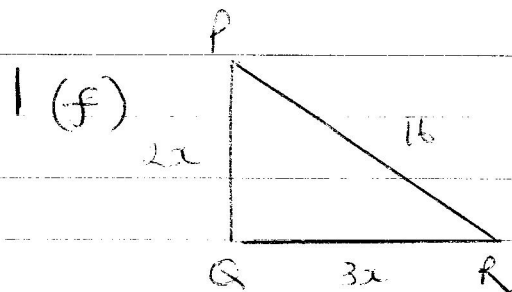
$\frac{1}{2} \frac{1}{2} \frac{1}{2}$

i.e. $y' = \frac{-3 + 20x - 15x^2}{(1 - 5x^2)^2}$

$\frac{1}{2}$

When $x = -1$ $y' = -2.375$

$\frac{1}{5}$



Using Pythagoras
 $(2x)^2 + (3x)^2 = (16)^2$
 (with or without brackets)

$$4x^2 + 9x^2 = 256$$

$$\therefore x = 4.44 \text{ cm}$$

$\therefore$ Sides are 5.88 cm

and 13.31 cm

1

1

1

1

$\frac{1}{2}$

$\frac{1}{2}$

6

2(a) (i) $(2 + q)(2 - q)$

1

1

(2)

(ii) $3ab + 4cd - cb - 12ad$

1

$$3a(b - 4d) - c(b - 4d)$$

$$(3a - c)(b - 4d)$$

1

1

1

(iii) $(p - q)(p + 7)$

Signs differ
7 and q

Correct ans

(4)

1

1

1

(5)

(iv) $q^2 - 4qr$
 $q(q - 4r)$

1

(1)

10

2(b) $6x^2 + 10x - 3x - 5 = 6x^2 - 54x - 5x + 45$
 $59x + 7x = 50$
 $\therefore x = 0.7575$
 $x = 0.76$

1

1

1

1

(5)

$$(11) \quad \frac{x-4}{5} = \frac{2x-1}{3}$$

$$3(x-4) = 5(2x-1)$$

$$3x - 12 = 10x - 5$$

$$-7 = 7x$$

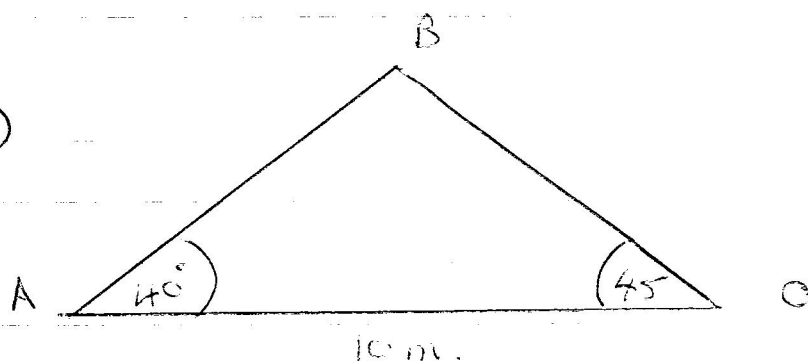
$$-1 = x$$

$$-1.00 = x$$

(4)

9

Q(c)



$$\therefore \hat{B} = 95^\circ$$

Using Sine Rule

$$\frac{BC}{\sin 40} = \frac{10}{\sin 95} = \frac{AB}{\sin 45}$$

$$\frac{BC}{\sin 40} = \frac{10}{\sin 95}$$

$$BC = \frac{10 \times \sin 40}{\sin 95} = 6.45 \text{ m}$$

$$\frac{AB}{\sin 45} = \frac{10}{\sin 95}$$

$$AB = \frac{10 \times \sin 45}{\sin 95} = 7.10 \text{ m}$$

Q(d)

$$(1) \quad \sin x = -0.75$$

$$x = \sin^{-1}(-0.75)$$

$$x = 180 + 48.59 = 228.59^\circ$$

$$\therefore x = 360 - 48.59 = 311.4^\circ$$

(3)

$$(ii) \quad \cos x = -0.5$$

$$\therefore x = \cos^{-1}(-0.5)$$

$$x = 180 - 60 = 120^\circ$$

$$x = 180 + 60 = 240^\circ$$

(2)

5

$$2(e) \quad (i) \quad y = x^3 e^{2x}$$

$$y' = x^3 \cdot 2e^{2x} + e^{2x} \cdot 3x^2$$

1 1

(2)

$$(ii) \quad y = \sin 5x \cos 3x$$

$$y' = \sin 5x (-3 \sin 3x) + (\cos 3x) (5 \cos 5x)$$

1 1

(2)

4

$$2(f) \quad Z = 2x^3y - 7y^3x + \sin x \cos y$$

$$\frac{\partial Z}{\partial x} = 6x^2y - 7y^3 + \cos x \cos y$$

$\frac{1}{2} \frac{1}{2} \frac{1}{2}$

$$\frac{\partial^2 Z}{\partial x^2} = 12xy - \sin x \cos y - 0$$

$\frac{1}{2} \frac{1}{2} \frac{1}{2}$

$$\frac{\partial Z}{\partial y} = 2x^3 - 21y^2x - \sin x \sin y$$

$\frac{1}{2} \frac{1}{2} \frac{1}{2}$

$$\frac{\partial^2 Z}{\partial y^2} = 0 - 42yx - \sin x \cos y$$

$\frac{1}{2} \frac{1}{2}$

$$\frac{\partial^2 Z}{\partial x \partial y} = 6x^2 - 21y^2 - \cos x \sin y$$

$\frac{1}{2} \frac{1}{2} \frac{1}{2}$

7

$$3(a) \quad 7x + 4y = 46 \quad \text{--- (1) } \times 8 \quad (\text{or equivalent})$$

$$5x + 6y = 57 \quad \text{--- (2) } \times 7$$

$$56x + 32y = 368$$

$$56x + 42y = 399$$

Subtract

$$-10y = -31$$

$$\therefore y = \frac{3.1}{1}$$

$$\text{In (1)} \quad 7x + 12.4 = 46$$

$$\therefore x = \frac{4.80}{1}$$

Solution, to 1 sig figure $y = 3 \quad x = 5$

1 1

6

$$3(b) \quad 3x^2 + 5x - 2 = 0$$

$$a=3 \quad b=5 \quad c=-2$$

$$\therefore x = \frac{-5 \pm \sqrt{(5)^2 - 4(3)(-2)}}{6}$$

$$x = \frac{-5 \pm \sqrt{49}}{6}$$

$$x = \frac{-5 \pm 7}{6}$$

$$\therefore x = \frac{2}{6} = 0.33 \quad (2 \text{ dec places})$$

$$x = \frac{-12}{6} = -2.00 \quad (2 \text{ dec places})$$

$$3(c) \quad (i) \quad (x+5)(x+6) = 0$$

$$\therefore x = -5 \text{ and } x = -6$$

$$(ii) \quad x^2 - 11x = 0$$

$$x(x-11) = 0$$

$$\therefore x = 0 \text{ and } x = 11$$

$$(iii) \quad (x+2)(x-2) = 0$$

$$\therefore x = -2 \text{ and } x = 2$$

$$3(d) \quad (i) \quad y = 6x^5 - 12x^4 + 30x^3 - 6x^2$$

$$y' = 30x^4 - 48x^3 + 90x^2 - 12x$$

$$(ii) \quad y = 7x^{-2} - 4x^{-1} + 8$$

$$y' = -14x^{-3} + 4x^{-2} + 0$$

$$(iii) \quad y = \frac{\sin x}{\cos x}$$

$$\text{This is } \tan x$$

$$y' = \sec^2 x$$

$$3 (e) \quad y = (2x^2 - 5x + 1)^7$$

$$y' = 7(2x^2 - 5x + 1)^6 (4x - 5)$$

1 1
(2)

$$(ii) \quad y = e^{x^2+4}$$

$$y' = 2x e^{x^2+4}$$

1
(1)

$$(iii) \quad y = \cos^3 2x$$

$$y' = 3(\cos 2x)^2 (-2 \sin 2x)$$

1
1 1
(3)
6

$$3 (f) \quad S = \frac{4 \cdot 5 + 5 \cdot 8 + 12 \cdot 5}{2}$$

$$S = 12.9$$

$$Area = \sqrt{12.9(12.9 - 4.5)(12.9 - 8.5)(12.9 - 12.5)}$$

$$= \sqrt{12.9 \times 8.4 \times 4.4 \times 0.4}$$

$$\sqrt{177.7104}$$

$$13.33$$

Square cm.

1
1
1
5