

National 5

Exam Solutions

NEW Specimen Paper (2017) Solutions

Paper 1

1. $\frac{19}{8} \times \frac{16}{5}$

$$\frac{19}{1} \times \frac{2}{5}$$

$$\frac{38}{5} = 7\frac{3}{5}$$

2.

$$11 - 2 - 6x < 39$$

$$9 - 6x < 39$$

$$-30 < 6x$$

$$-5 < x$$

$$x > -5$$

3.

$$u + v = \begin{pmatrix} 2+7 \\ -5+4 \\ -3+(-1) \end{pmatrix} = \begin{pmatrix} 9 \\ -1 \\ -4 \end{pmatrix}$$

$$|u + v| = \sqrt{9^2 + (-1)^2 + (-4)^2}$$

$$|u + v| = \sqrt{81+1+16}$$

$$|u + v| = \sqrt{98}$$

$$|u + v| = \sqrt{49}\sqrt{2}$$

$$|u + v| = 7\sqrt{2}$$

4. $y = ax^2$

$$45 = k \times (-3)^2$$

$$45 = 9a$$

$$a = 5$$

$$y = 5x^2$$

5. $a = 7$ $b = 5$ $c = -1$

$$b^2 - 4ac$$

$$5^2 - 4 \times 7 \times (-1)$$

$$25 - (-28) = 53$$

$$b^2 - 4ac > 0$$

2 real and distinct roots

6. $m = \frac{y_2 - y_1}{x_2 - x_1}$

$$m = \frac{340 - 100}{15 - 3} = \frac{240}{12} = 20$$

$$y - b = m(x - a)$$

$$y - 100 = 20(x - 3)$$

$$y - 100 = 2x - 60$$

$$y = 2x + 40$$

$$W = 2A + 40$$

b) 1 year = 12 months

$$y(12) = 2 \times 12 + 40 = 64\text{kg}$$

7.	12	16	17	18	18	21	22	26	27	27
			Q1			Q2		Q3		
			17			19.5		26		

Median = 19.5

$$\text{SIQR} = \frac{26-17}{2} = \frac{9}{2} = 4.5$$

- b Median has increased
On average in the second round scores have gone up

SIQR has decreased.

Scores were less spread out in second round.

8. a $5a + 3c = 158.25$

b $3a + 2c = 98$

c
$$\begin{array}{rcl} 5a + 3c & = & 158.25 & \textcircled{1} \times 2 \\ 3a + 2c & = & 98 & \textcircled{2} \times 3 \end{array}$$

$$\begin{array}{rcl} 10a + 6c & = & 316.5 & \textcircled{3} \\ 9a + 6c & = & 294 & \textcircled{4} \end{array}$$

$$\textcircled{3} - \textcircled{4}$$

$$a = 22.5$$

Sub $a = 22.5$ into $\textcircled{4}$

$$3a + 2c = 98$$

$$67.5 + 2c = 98$$

$$2c = 30.5$$

$$c = 15.25$$

$$\text{Adult} = \text{£}22.50$$

$$\text{Child} = \text{£}15.25$$

9. 80% = 480 000
 10% = 60 000
 100% = £600 000

10. $f(5) = \frac{2}{\sqrt{5}}$

$$f(5) = \frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$$

11. a $AB = -a + b$ or $AB = b - a$

 b $OC = b + b - a - a$
 = $2b - 2a$

12. max 4 and min -4

$$a = 4$$

3 waves

$$b = 3$$

13. a $y = (x - 4)^2 + b$

$$y = x^2 - 8x + 16 + b$$

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

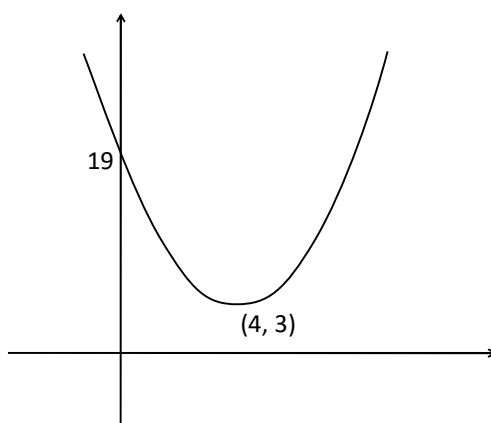
b y intercept when $x = 0$

$$y = (-4)^2 + 3$$

$$= 16 + 3 = 19 \quad (0, 19)$$

$$\text{TP} = (4, 3)$$

Positive x^2 , so minimum TP



$$14. \quad \frac{4}{(x+2)} \frac{(x-4)}{(x-4)} - \frac{3}{(x-4)} \frac{(x+2)}{(x+2)}$$

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

$$\frac{4x - 16 - 3x - 6}{(x+2)(x-4)}$$

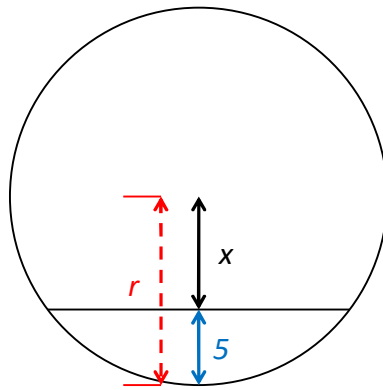
$$\frac{x - 22}{(x+2)(x-4)}$$

$$15. \quad \tan^2 x = \frac{\sin^2 x}{\cos^2 x}$$

$$\frac{\sin^2 x}{\cos^2 x} \times \cos^2 x = \sin^2 x$$

16.

a) $x = r - 5$



b)

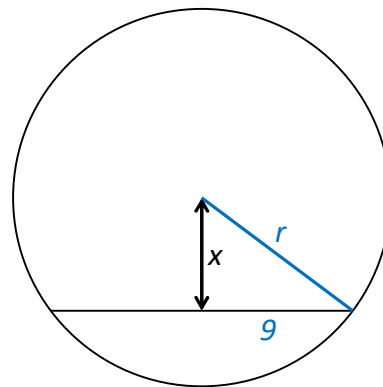
$$r^2 = x^2 + 9$$

$$r^2 = (r - 5)^2 + 9^2$$

$$r^2 = r^2 - 10r + 25 + 81$$

$$10r = 106$$

$$r = 10.6 \text{ cm}$$



Paper 2

1. 64×1.15^3

$$97.336$$

97 miles

2. $5.5 \text{ litres} = 5500 \text{ ml}$

$$5500 \times 3 \times 10^5 = 1\,650\,000\,000$$

$$= 1.65 \times 10^9$$

3. $(2x + 3)(x^2 - 4x + 1)$

$$\begin{array}{r} 2x^3 - 8x^2 + 2x \\ + 3x^2 - 12x + 3 \end{array}$$

$$2x^3 - 5x^2 - 10x + 3$$

4. a) A & B share x and y coordinates

B (8, 4, 10)

b) C (4, 0, 10)

5. $a^2 = b^2 + c^2 - 2bc \cos A$

$$a^2 = 8^2 + 3^2 - 2 \times 8 \times 3 \times \cos 120$$

$$a^2 = 64 + 9 - (-24) = 97$$

$$a = \sqrt{97} = 9.85 \text{ cm}$$

$$\begin{aligned}
6. \quad V_{\text{hemisphere}} &= \frac{1}{2} \text{ of } \frac{4}{3} \pi r^3 \\
&= \frac{1}{2} \times \frac{4}{3} \times 3.14 \times 6^3 \\
&= 452.16 \text{ cm}^3 \quad (452.3893..) \\
V_{\text{cone}} &= \frac{1}{3} \pi r^2 h \\
&= \frac{1}{3} \times 3.14 \times 6^2 \times 11 \\
&= 414.48 \text{ cm}^3 \quad (414.69023..) \\
V_{\text{total}} &= 866.64 \quad (867.0795 \text{ cm}^3) \\
&= 870 \text{ cm}^3
\end{aligned}$$

$$\begin{aligned}
7. \quad \text{Scale factor} &= \frac{36}{15} = 2.4 \\
\text{Vol S.F} &= 2.4^3 = 13.824 \\
\text{Large Vol} &= 250 \times 2.4^3 = 3456 \text{ ml}
\end{aligned}$$

$$\begin{aligned}
8. \quad &\frac{10n^6}{2n^2} \\
&5n^4
\end{aligned}$$

9. a rearrange to $y = mx + c$

$$3y = -4x + 12$$

$$y = \frac{-4}{3}x + 4$$

$$m = -\frac{4}{3}$$

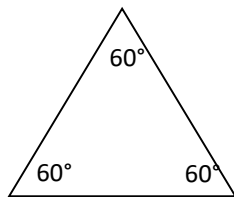
b crosses y axis at $x = 0$

$$4 \times 0 + 3y = 12$$

$$3y = 12$$

$$y = 4$$

10. $360 \div 6 = 60$



$$A_{\text{tri}} = \frac{1}{2} a b \sin C$$

$$A_{\text{tri}} = \frac{1}{2} \times 20 \times 20 \times \sin 60$$

$$A_{\text{tri}} = 173.20508 \text{ cm}^2$$

$$A_{\text{table}} = \text{---} \times 6$$

$$= 1039.23048 \text{ cm}^2$$

11. a)

$$A = \frac{110}{360} \times \pi r^2$$

$$A = \frac{110}{360} \times \pi \times 30^2$$

$$A = 863.5 \text{ cm}^2 \quad (863.937979\dots)$$

b)

$$l = \frac{250}{360} \times \pi d$$

$$l = \frac{250}{360} \times \pi \times 60$$

$$l = 130.8333 \text{ cm} \quad (130.89969)$$
$$= 130.83 \text{ cm}$$

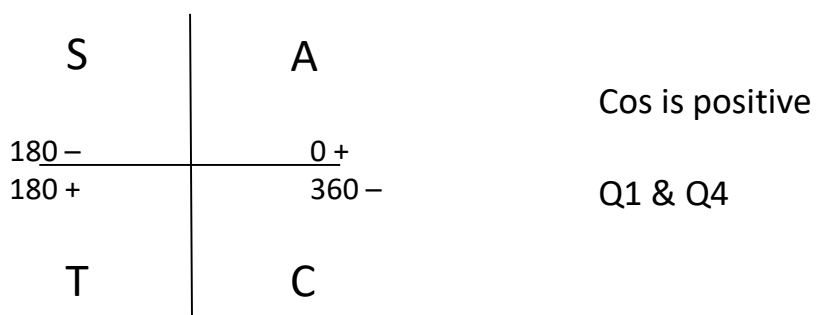
12. $3 \cos x - 1 = 0$

$$3 \cos x = 1$$

$$\cos x = 1/3 = 0.333\dots$$

Base angle

$$\begin{aligned} x &= \cos^{-1}(1/3) \\ &= 70.5^\circ \end{aligned}$$



In Q1 $x = 70.5^\circ$

In Q4 $x = 360 - 70.5$
 $= 289.5^\circ$

13.

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

$$\frac{x}{x+5}$$

14

$$s - ut = \frac{1}{2} at^2$$

$$\frac{1}{2} at^2 = s - ut$$

$$at^2 = 2s - 2ut \qquad 2(s - ut)$$

$$a = \frac{2s - 2ut}{t^2} \qquad \frac{2(s - ut)}{t^2}$$

$$\text{a) } \frac{50}{\sin D} = \frac{79}{\sin 130}$$

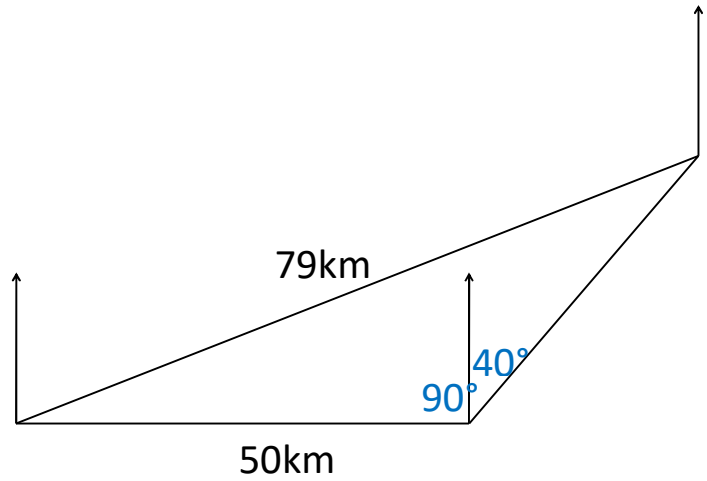
$$\frac{\sin D}{50} = \frac{\sin 130}{79}$$

$$\sin D = \frac{50 \sin 130}{79}$$

$$\sin D = 0.48483$$

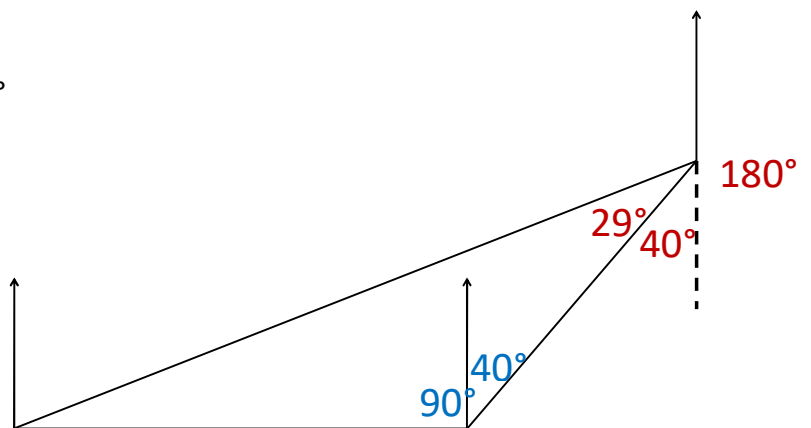
$$D = 29.001^\circ$$

(use 29°)



- b)** Create line underneath D
Alternate angle makes 40°

$$180 + 40 + 29 = 249^\circ$$



$$16. \text{ ai} \quad \text{length} = x + 13 + x$$

$$= 2x + 13$$

$$\text{a ii} \quad \text{Area} = 270\text{cm}^2$$

$$\text{Area}_{\text{rectangle}} = L \times B$$

$$= (2x + 13)(2x + 9)$$

$$= 4x^2 + 18x + 26x + 117$$

$$= 4x^2 + 44x + 117$$

$$4x^2 + 44x + 117 = 270$$

$$4x^2 + 44x - 153 = 0$$

$$\mathbf{b} \quad 4x^2 + 44x - 153 = 0$$

$$a = 4, b = 44, c = -153$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-44 \pm \sqrt{44^2 - 4 \times 4 \times -153}}{2 \times 4}$$

$$x = \frac{-44 \pm \sqrt{1936 - -2448}}{8}$$

$$x = \frac{-44 \pm \sqrt{4384}}{8}$$

$$x = \frac{-44 + \sqrt{4384}}{8} \quad \text{or} \quad x = \frac{-44 - \sqrt{4384}}{8}$$

$$x = 2.77647267862 \quad \text{or} \quad x = -13.7764726786$$

x is a length and cannot be negative

$$x = 2.8\text{cm}$$