MATHS HUNTER

# National 5

# Exam Solutions

## 2017 Solutions

**Paper 1**

**1.** $f(-5) = (-5)^2 + 3\times(-5)$

$= 25 - 15$

$= 10$

**2.**

198 216 <u>218</u> 230 232 | 247 248 <u>250</u> 265 267

Q1 Q3

$\text{SIQR} = \frac{Q_3 - Q_1}{2}$

$= \frac{250 - 218}{2}$

$= \frac{32}{2} = 16$

**3.** $\frac{11}{6} \times \frac{4}{3}$

$\frac{44}{18} = \frac{22}{9}$

$2\frac{4}{9}$

**4.** $2x^3 - 8x^2 + 2x$

$+ 3x^2 - 12x + 3$

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

**5.** B(0, 6, 6)

C(3, 3, 9)

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

$= \frac{-2-6}{3-(-1)} = \frac{-8}{4} = -2$

$y - b = m(x - a)$ $(a, b) = (-1, 6)$

$y - 6 = -2(x - (-1))$

$y - 6 = -2(x + 1)$

$y - 6 = -2x - 2$

$y = -2x + 4$

**7.** Area $= \frac{1}{2}ab\sin C$

$= \frac{1}{2}8\times12\times\frac{2}{3}$

$= 4 \times 8 = 32\text{m}^2$

**8.** $19 + x > 15 + 3(x - 2)$

$19 + x > 15 + 3x - 6$

$19 + x > 9 + 3x$

$10 > 2x$

$5 > x$

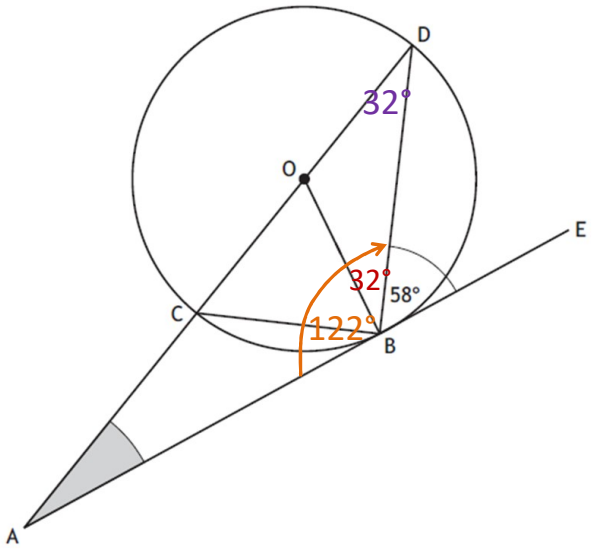
$x < 5$

**9.**

90° – 58°= 32°(tangent)
Isosceles triangle => 32

90 + 32 = 122°

180 – 32 – 122 = 26°




**10.** $Fc = t^2 + 4b$

$$Fc - t^2 = 4b$$

$$\frac{Fc - t^2}{4} = b$$

$$b = \frac{Fc - t^2}{4}$$

**11.** $\frac{3}{a^2} - \frac{2}{a} \times \frac{a}{a}$

$\frac{3}{a^2} - \frac{2a}{a^2}$

$\frac{3-2a}{a^2}$

**12.** $\bar{x} = \frac{1+4+6+3+6}{5} = \frac{20}{5} = 4$

| x | $\bar{x}$ | $x-\bar{x}$ | $(x-\bar{x})^2$ |
|---|---|---|---|
| 1 | 4 | –3 | 9 |
| 3 | 4 | –1 | 1 |
| 4 | 4 | 0 | 0 |
| 6 | 4 | 2 | 4 |
| 6 | 4 | 2 | 4 |
| | | | 18 |

$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$

$= \sqrt{\frac{18}{4}}$

$= \frac{\sqrt{18}}{\sqrt{4}}$

$= \frac{\sqrt{9}\sqrt{2}}{2}$

$= \frac{3\sqrt{2}}{2}$

a = 3, b = 2

**13.** Simultaneous eqn

$3x - y = 2$ ① × 3
$x + 3y = 19$ ② × 1

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$9x - 3y = 6$ ③
$x + 3y = 19$ ④

③+④

$10x = 25$
$x = 2{\cdot}5$

Sub $x = 2{\cdot}5$ into ①

$7{\cdot}5 - y = 2$

$y = 5{\cdot}5$

P(2·5, 5·5)

**14**. a) $a = +5$

b) $y = (x + 5)^2 + b$

$8 = (-3 + 5)^2 + b$

$8 = 2^2 + b$
$8 = 4 + b$

$\Rightarrow b = 4$

**15.** Scale factor with similar triangles

S.F 1 = $\frac{7}{5}$ S.F 2 = $\frac{x + 2{\cdot}6}{x}$

$\frac{7}{5} = \frac{x + 2{\cdot}6}{x}$

$7x = 5(x + 2{\cdot}6)$

$7x = 5x + 13$ (working useful for $5 \times 2{\cdot}6$)

$2x = 13$

$x = 6{\cdot}5\text{cm}$

**PAPER 2**

**1.** $\sqrt{18^2 + (-14)^2 + 3^2}$

$\sqrt{324 + 196 + 9}$

$\sqrt{529} = 23$

**2.** $1200 \times 1{\cdot}045^3$

1369·399

£1369

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

$a^2 = 250^2 + 180^2 - 2 \times 250 \times 180 \times \cos 147$

$a^2 = 170380{\cdot}3511$

$a = 412{\cdot}77\text{m}$

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

$x = \dfrac{-5 \pm \sqrt{5^2 - 4 \times 2 \times -4}}{2 \times 4}$

$x = \dfrac{-5 \pm \sqrt{25 - (-32)}}{8}$

$x = \dfrac{-5 \pm \sqrt{57}}{8}$

$x = \dfrac{-5 + \sqrt{57}}{8}$ or $x = \dfrac{-5 - \sqrt{57}}{8}$

$x = 0{\cdot}637$ or $x = -3{\cdot}137$

$= 0{\cdot}6$ $= -3{\cdot}1$

**5.** 115% = 4830
÷1·15

100% = 4200

**6.** $V_{large} = \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi \times 12^3$

= 7238·229474
= 7238·2 mm³

Diameter of small sphere = 24 – 3 – 3 = 18
r = 9

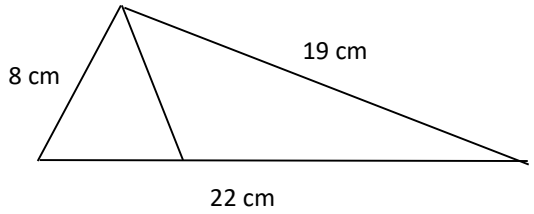
$V_{small} = \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi \times 9^3$

= 3053·628059
= 3053·6 mm³

Coating = $V_{large} - V_{small}$
= 4184·6
= 4180 mm³

**7.** let a = 8 cm
b = 19 cm
c = 22cm




If $a^2 + b^2 = c^2$ then this is a right angled triangle

$a^2 + b^2 = 8^2 + 19^2$

$= 425$

$c^2 = 22^2$

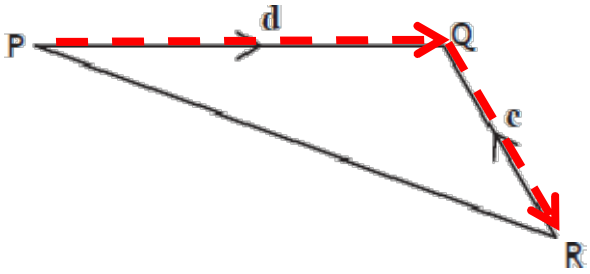
$= 484$

$a^2 + b^2 \neq c^2$

Therefore by the converse of pythagoras this is not a right angled triangle

**8.** a)

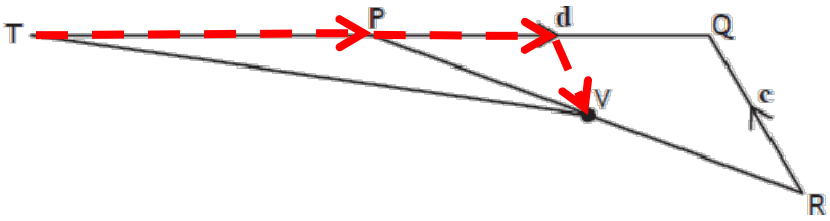
$d - c$




**b** $d + \frac{1}{2}d - \frac{1}{2}c$

$\frac{3}{2}d - \frac{1}{2}c$

$\frac{3d - 2c}{2}$



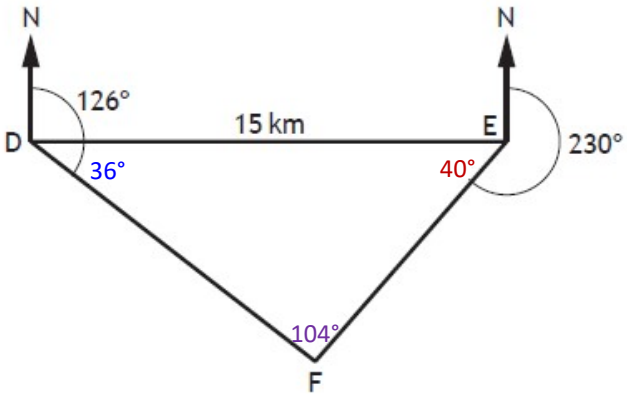

**9** a $(2x - 5)(2x + 5)$

b $\frac{(2x-5)(2x+5)}{2x^2 - x - 10}$

$\frac{\cancel{(2x-5)}(2x+5)}{\cancel{(2x-5)}(x+2)}$

$\frac{2x+5}{x+2}$

**10.**




126 – 90 =36

360 – 230 – 90 = 40

180 – 36 – 40 = 104

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{x}{\sin 40°} = \frac{15}{\sin 104°}$$

$$x = \frac{15\sin 40}{\sin 104°}$$

$$x = 9{\cdot}9369856$$
$$= 9{\cdot}9 \text{ km}$$

**11.**

$$3x - 5y - 10 = 0$$

$$3x - 10 = 5y$$

$$5y = 3x - 10$$

$$y = \frac{3}{5}x - 2$$

$$m = \frac{3}{5}$$

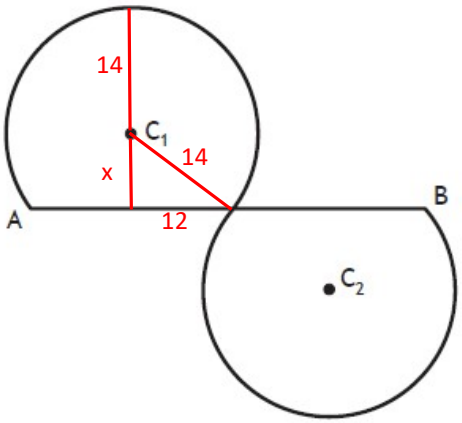
**12.**

$$\sqrt[3]{x} = x^{\frac{1}{3}}$$

$$\frac{1}{\sqrt[3]{x}} = x^{-\frac{1}{3}}$$

**13.**

$48 \div 4 = 12$ cm




$x^2 = 14^2 - 12^2$

$= 52$

$x = \sqrt{52}$
$= 7{\cdot}211$
$= 7{\cdot}2$ cm

$h = 14 + 7{\cdot}2 + 7{\cdot}2 + 14$
$= 42{\cdot}4$ cm

**14.** $r = 6{\cdot}4$cm, $d = 12{\cdot}8$ cm

$\frac{x}{360} \times \pi d = 31{\cdot}5$

$\frac{x}{360} \times \pi \times 12{\cdot}8 = 31{\cdot}5$

$(0{\cdot}1117..)\, x = 31{\cdot}5$

$x = 31{\cdot}5 \div (0{\cdot}1117)$ (use Ans button)

$x = 282{\cdot}0026648$
$= 282°$

**15. a** $h(60) = 40 + 23\cos(60)$

$= 51{\cdot}5\text{m}$

**b** Min height of cos graph occurs at $x = 180°$ *(where cos 180 = –1)*

$h(180) = 40 + 23\times(-1)$

$= 40 - 23 = 17\text{m}$

**c** $40 + 23\cos x = 61$

$23\cos x = 21$

$\cos x = \frac{21}{23} = 0{\cdot}913043$

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

$= 24{\cdot}1°$ (in Q1)

Cos x is positive!

Cos x is positive in Q1 and Q4

In Q4: $x = 360 - 24{\cdot}1$

$= 335{\cdot}9°$