Worked Solutions for ENGAA Papers by Topic

Section 1

Topic: Number

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ENGAA S1 2019 - Question 1

1 Evaluate

$$\left(\sqrt{7}+\sqrt{3}\right)^2-\left(\sqrt{7}-\sqrt{3}\right)^2$$

A 0

B $2\sqrt{7}$

C $4\sqrt{7}$

D $2\sqrt{21}$

E 10

F $4\sqrt{21}$

G 20

ENGAA S1 2019 - Question 1 - Worked Solution

$$\left(\sqrt{7}+\sqrt{3}\right)^2-\left(\sqrt{7}-\sqrt{3}\right)^2$$
$$=7+2\sqrt{21}+3-\left(7-2\sqrt{21}+3\right)$$
$$=4\sqrt{21}$$

Answer is F

ENGAA S1 2018 - Question 1

1 A group of drivers, consisting of 200 women and 300 men, was asked if they passed their driving test at the first attempt.

Altogether 167 of the group said they passed at the first attempt.

Of the women, 143 said they did not pass at the first attempt.

How many of the men said they passed at the first attempt?

A 10

B 24

C 33

D 57

E 110

F 133

G 157

ENGAA S1 2018 - Question 1 - Worked Solution

Number of women passing in 1st attempt:

200 – 143 = 57

Number of men passing in 1st attempt:

167 – 57 = 110

Answer is E.

ENGAA S1 2018 - Question 20

20 A student places a measuring cylinder on a balance. She pours a volume V of water into the measuring cylinder, and finds that the mass of the measuring cylinder and water together is 290 g.

She then empties the measuring cylinder and dries it before putting it back on the balance.

She now pours the same volume V of olive oil into the measuring cylinder, and finds that the mass of the measuring cylinder and olive oil together is 270 g.

What is the mass of the measuring cylinder?

(densities: olive oil = 0.90 g cm^{-3}; water = 1.0 g cm^{-3})

A 18 g

B 20 g

C 90 g

D 180 g

E 200 g

ENGAA S1 2018 - Question 20 - Worked Solution

$$M_w + M_c = 290g$$
$$M_o + M_c = 270g$$
$$M = \rho V$$
$$M_w = 1 \times V = V$$
$$M_o = 0.9V$$
$$V = M_c = 290 \quad ①$$
$$0.9V + M_c = 270 \quad ②$$
$$① - ②$$
$$0.1V = 20$$
$$V = 200$$
Sub into ①
$$M_c = 290 - 200$$
$$= 90g$$

Answer is C.

ENGAA S1 2017 - Question 1

1 Evaluate

$$\frac{\left(\sqrt{12}+\sqrt{3}\right)^2}{\left(\sqrt{12}-\sqrt{3}\right)^2}$$

A 1

B 3

C $\frac{5}{3}$

D $\frac{7}{3}$

E $3\sqrt{3}$

F 9

ENGAA 2017 - Question 1 - Worked Solution

$$\frac{\left(\sqrt{12}+\sqrt{3}\right)^2}{\left(\sqrt{12}+\sqrt{3}\right)^2} = \frac{\left(\sqrt{12}+\sqrt{3}\right)\left(\sqrt{12}+\sqrt{3}\right)}{\left(\sqrt{12}-\sqrt{3}\right)\left(\sqrt{12}-\sqrt{3}\right)}$$

$$= \frac{\left(\sqrt{12}\right)^2+\sqrt{3}\sqrt{12}+\sqrt{3}\sqrt{12}+\left(\sqrt{3}\right)^2}{\left(\sqrt{12}\right)^2-\sqrt{3}\sqrt{12}-\sqrt{3}\sqrt{12}+\left(\sqrt{3}\right)^2}$$

$$= \frac{12+3+2\sqrt{36}}{12+3-2\sqrt{36}}$$

$$= \frac{15+(2\times 6)}{15-(2\times 6)}$$

$$= \frac{27}{3}$$

$$= 9$$

Answer is F.

ENGAA S1 2017 - Question 9

9 P is directly proportional to Q squared.

When P is 2, Q is 4.

Q is inversely proportional to R.

When Q is 2, R is 5.

What is P in terms of R?

A $P = \frac{5}{R}$

B $P = \frac{5}{4R}$

C $P = \frac{1}{800R^2}$

D $P = \frac{5}{4R^2}$

E $P = \frac{25}{2R^2}$

F $P = \frac{800}{R^2}$

G $P = \frac{R^2}{50}$

H $P = \frac{25R^2}{2}$

ENGAA 2017 - Question 9 - Worked Solution

$$① \ P \propto Q^2$$
$$P = kQ^2 \, , k = Constant$$
$$② \quad P = 2 \quad , \quad Q = 4$$

So

$$2 = k(4)^2$$
$$2 = 16k$$
$$P = 4^2/8$$

$$③ \quad Q \propto \frac{1}{R}$$

$$Q = \frac{c}{R} \ , \quad c = another\ constant$$

$$④ \quad Q = 2 \, , R = 5$$

So

$$2 = \frac{c}{5}$$

$$c = 5 \times 2$$

$$c = 10$$

$$Q = \frac{10}{R}$$

$$P = \frac{Q^2}{8}$$

$$P = \left(\frac{10}{R}\right)^2 \times \frac{1}{8}$$

$$P = \frac{100}{8R^2}$$

$$P = \frac{25}{2R^2}$$

Answer is E

ENGAA S1 2017 - Question 15

15 There are 100 students in Year 10.

Each student studies exactly one of French, German, and Spanish.

X girls study French and there are $3X$ girls in total.

$2Y$ boys study German.

There are 35 students studying Spanish of which Y are boys.

Which of the following is an expression for the total number of students studying German?

A $X+2Y$

B $X+Y+35$

C $X+3Y-35$

D $2X+2Y$

E $2X+Y-35$

F $2X+3Y-35$

G $2X+Y+35$

ENGAA 2017 - Question 15 - Worked Solution

Draw table and fill in using information from question

	French	German	Spanish	Total
G	X			3Y
B		2Y	Y	
Total		?	35	100

Fill in table using "total" column/row

	French	German	Spanish	Total
G	X			3X
B	100-3X-3Y	2Y	Y	100-3X
Total	100-2X-3Y	2X+3Y-35	35	100

So number of German students is :

$$2X + 3Y - 35$$

Answer is F.

ENGAA S1 2017 - Question 29

29 Which one of the following is a simplification of

$$1-\left(\frac{3+\sqrt{3}}{6-2\sqrt{3}}\right)^2$$

A $-\frac{3}{4}$

B $\frac{3}{4}$

C $-\frac{3}{4}-\frac{\sqrt{3}}{7}$

D $\frac{3}{4}-\frac{\sqrt{3}}{7}$

E $-\frac{3}{4}-\sqrt{3}$

F $\frac{3}{4}-\sqrt{3}$

G $-\frac{\sqrt{3}}{2}$

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

ENGAA S1 2017 - Question 29 - Worked Solution

$$1-\left(\frac{3+\sqrt{3}}{6-2\sqrt{3}}\right)^2$$

$$= 1-\frac{(3+\sqrt{3})(3+\sqrt{3})}{(6-2\sqrt{3})(6-2\sqrt{3})}$$

$$= 1-\frac{9+3+3\sqrt{3}+3\sqrt{3}}{36+(4\times 3)-(6\times 2\sqrt{3})-(6\times 2\sqrt{3})}$$

$$= 1-\frac{12+6\sqrt{3}}{48-24\sqrt{3}}$$

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

$$= \frac{6 - 5\sqrt{3}}{4(2 - \sqrt{3})}$$
$$= \frac{(6 - 5\sqrt{3})(2 + \sqrt{3})}{4(2 - \sqrt{3})(2 + \sqrt{3})}$$
$$= \frac{-3 - 4\sqrt{3}}{4 \times 1}$$
$$= \frac{3}{4} - \sqrt{3}$$

Answer is E

ENGAA S1 2016 - Question 3

Which one of the following is a simplification of $(\sqrt{3}-\sqrt{2})^2$?

A $1-2\sqrt{3}\sqrt{2}$

B $5-2\sqrt{2}\sqrt{3}$

C $2\sqrt{3}-2\sqrt{2}$

D 1

E $5-\sqrt{2}\sqrt{3}$

F $13-2\sqrt{2}\sqrt{3}$

G $5+2\sqrt{2}\sqrt{3}$

H 5

ENGAA S1 2016 - Question 3 - Worked Solution

$$(\sqrt{3}-\sqrt{2})^2 = \sqrt{3}^2+\sqrt{2}^2-2\sqrt{3}\sqrt{2}$$
$$= 3+2-2\sqrt{6}$$
$$= 5-2\sqrt{2}\sqrt{3}$$

Answer is B

ENGAA S1 2016 - Question 7

7 The mean age of the twenty members of a running club is exactly 28.

The mean age increases by exactly 2 years when two new members join.

What is the mean age of the two new members?

A 20 years

B 22 years

C 30 years

D 40 years

E 50 years

F 52 years

ENGAA S1 2016 - Question 7 - Worked Solution

$$Total\ combined\ age = mean\ age \times number\ of\ people$$
$$Before\ = 28 \times 20 = 560$$
$$After = 30 \times 22 = 660$$
$$The\ combined\ age\ increased\ by\ 100$$
$$The\ two\ new\ nembers\ have\ a\ mean\ age\ of\ 50$$

Answer is E

ENGAA S1 2016 - Question 9

9 A medical scanner is bought for £15 000.

The value of the scanner depreciates by 20% every year.

By how much has the scanner reduced in value after 2 years?

A £600

B £3000

C £5400

D £6000

E £9000

F £9600

G £12 000

ENGAA S1 2016 - Question 9 - Worked Solution

$$V_{t+1} = 0.8V_t$$

The value one year after is 0.8 x the value of the previous year

$$After\ 2\ years:\ V_2 = 0.8^2 \times V_o = \zeta 9600$$

$$\Delta V = V_o - V_1 = \zeta 5400$$

Answer is C

ENGAA S1 2016 - Question 10

10 The total power P radiated by a star is given by:

$$P = kR^2T^4$$

where R is the radius of the star, T is its surface temperature and k is a constant.

The power currently radiated by the Sun is 4.0×10^{26} W. Towards the end of the Sun's life its radius will increase by a factor of a hundred and its surface temperature will decrease by a factor of two.

What will be the power radiated by the Sun when these changes have occurred?

A 2.5×10^{27} W

B 1.0×10^{28} W

C 2.0×10^{28} W

D 2.5×10^{29} W

E 1.0×10^{30} W

F 2.0×10^{30} W

G 2.5×10^{33} W

H 1.0×10^{34} W

ENGAA S1 2016 - Question 10 - Worked Solution

$$P = KR^2T^4$$
$$R^1 = 100R$$
$$T^1 = \frac{T}{2}$$
$$P^1 = K(100R)^2\left(\frac{T}{2}\right)^4$$
$$P^1 = KR^2T^4 \times \frac{100^2}{2^4}$$
$$P^1 = 635P$$
$$P = 4.0 \times 10^{26}w$$
$$P^1 = 2.5 \times 10^{29}w$$

Answer is D